2.8

LWG
LOWER WILLAMETTE GROUP

PORTLAND HARBOR RI/FS

CONCEPTUAL SITE MODEL UPDATE

VOLUME II

DRAFT

EPA Region 10 Superfund
RELEASABLE
Date ________
Initial ________

September 17, 2004

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The Lower Willamette Group

Prepared by:
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USEPA SF
1210617

Appendix A

APPENDIX A

SITE SUMMARIES

LIST OF ACRONYMS

ABV	apparent baseline value
Anchor	Anchor Environmental, L.L.C.
AST	aboveground storage tank
AWQC	acute water quality criteria
BES	Bureau of Environmental Services
bgs	below ground surface
BNSF	Burlington Northern Santa Fe Railroad Company
BOD	biological oxygen demand
Brix	Brix Maritime Copmany
BTEX	benzene, toluene, ethybenzene, xylene
CEG	conditionally exempt generator
COI	chemical of interest
COP	City of Portland
COPC	contaminant of potential concern
CRBG	Columbia River Basalt Group
DDT	dichlorodiphenyltrichloroethane
DEQ	(Oregon) Department of Environmental Quality
DNAPL	dense non-aqueous phase liquid
DSL	(Oregon) Department of State Lands
ECSI	Environmental Cleanup Site Information
ELF	Societe Nationale Elf Aquitaine
EP	extraction procedure
EPA	U.S. Environmental Protection Agency
ERIS	Emergency Response Information System
ERNS	Emergency Response Notification System
ESA	environmental site assessment
ETS	extraction and treatment system
Foss	Foss Maritime Company
FS	feasibility study
ft/d	feet per day
gpm	gallons per minute
HAI	Hahn and Associates, Inc.
HPAH	high molecular weight polycyclic aromatic hydrocarbon
HVOC	halogenated volatile organic compound
IRAM	interim remedial action measure
IRM	interim remedial measure

LIST OF ACRONYMS

ISA	initial study area
K	conductivity
KMLT	Kinder Morgan Liquid Terminals
LNAPL	light non-aqueous phase liquid
LNG	liquified natural gas
LPAH	low molecular weight polycyclic aromatic hydrocarbon
LUST	leaking underground storage tank
LWR	lower Willamette River
MCB	monochlorobenzene
MEK	methyl ethyl ketone
MFA	Maul Foster & Alongi, Inc.
mg/kg	milligram per kilogram
mg/L	milligrams per liter
MIBK	methyl isobutyl ketone
MIP	membrane interface probe
MOCC	McCall Oil & Chemical Corporation
MPR	manufacturing process residue
MRL	method reporting limit
MSL	mean sea level
MTBE	methyl-t-butyl ether
NAPL	non-aqueous phase liquid
NAVD	North American Vertical Datum
NFA	No Further Action
NGVD	National Geodetic Vertical Datum
NPDES	National Pollutant Discharge Elimination System
ODOT	Oregon Department of Transportation
OWS	oil-water separator
PA	preliminary assessment
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyls
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans
PCE	tetrachloroethene
POTW	publically owned trreatment works
ppb	parts per billion
ppm	parts per million

LIST OF ACRONYMS

PRG	preliminary remediation goal
QA/QC	quality assurance/quality control
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RI	remedial investigation
RM	river mile
ROD	Record of Decision
OCDD	octachlorodibenzo-p-dioxin
SIC	Standard Industrial Classification
SIM	select ion monitoring
SLVs	screening level values
SPH	separate phase hydrocarbons
SPINS	(Oregon) Spill Information Network System
SQG	small quantity generator
STA	Sediment Trend Analysis®
SVOC	semi-volatile organic compounds
TCA	1,1,1-trichloroethane
TCLP	toxicity characteristic leaching procedure
TPH	total petroleum hydrocarbons
TSS	total suspended solids
ug/kg	microgram per kilogram
ug/L	microgram per liter
UIC	underground injection control
UST	underground storage tank
VCP	voluntary cleanup program
VES	vapor extraction system
VOC	volatile organic compound
WBZ	water bearing zone
WCC	Woodward-Clyde Consultants
WPCF	water pollution control facilities
XPA	expanded preliminary assessment

Analytical Chemistry Data Qualifier Definitions

Analytical Chemistry Data Qualifier Definitions

Qualifier	Qualifier Description
A	Sum as WAC173-204-320 (LPAH,HPAH), DMMO (DDT,PCBs)
B	Analyte found in associated blank.
E (non-organics)	Estimated because of the presence of interference.
E (organics)	Exceed calibration range of GC/MS instrument.
EG	Combined qualifier.
EJ	Combined qualifier.
EM	Combined qualifier.
G	Estimate is greater than value shown.
GB	Combined qualifier.
GH	Combined qualifier.
GM	Combined qualifier.
H	Holding time exceeded.
HJ	Combined qualifier.
J	Estimated value.
JB	Combined qualifier.
JM	Combined qualifier.
JN	Combined qualifier.
JP	Combined qualifier.
JT (Round 1)	Combined qualifier.
JV	Combined qualifier.
L	Value is less than the maximum shown.
LM	Combined qualifier.
M	Value is a mean.
N (non-organics)	Sample recovery not within control limits.
N (organics)	Presumptive evidence of a compound.
NJ	Combined qualifier.
NJT (Round 1)	Combined qualifier.
NQ	Detected but not quantified.
NT (Round 1)	Combined qualifier.
P	GC/HPLC criteria exceeded RPD>40% (>25% CLP pests)
Q	Questionable value.
T (Historical)	Detected below quantification limit shown.
T (Round 1)	Result derived or selected from >1 reported value.
U	Analyte was analyzed for but not detected.
UA	All summed analytes undetect, high detection shown
UB	Combined qualifier.
UE	Combined qualifier.
UG	Combined qualifier.
UGH	Combined qualifier.
UH	Combined qualifier.
UI	Combined qualifier.
UIJ	Combined qualifier.
UJ	Not detected. Sample detection limit is estimated.
UJP	Combined qualifier.
UJT (Round 1)	Combined qualifier.
UM	Combined qualifier.
UN	Combined qualifier.
UP	Combined qualifier.
UT (Round 1)	Combined qualifier.
UX	Combined qualifier.
V	In diesel range but doesn't match diesel standard.
X	Recovery less than 10%.
Z	Fingerprint does not resemble petroleum product.

Site Summary Reader's Guide

Last template update: 5/14/04

This readers guide has been prepared to assisted readers in understanding the intent and scope of the various sections of the site summaries and to provide authors and technical reviewers a consistent approach to the summaries. The guide applies to the first update of the CSM (August 2004). As such, some sections have been intentionally deferred or are partially complete due to lack of complete data (e.g., sections related to the relationship of upland sources to in-water media), or have been intentionally deferred because information has not been assembled (e.g., DSL permits).

Key concepts for the Summaries are listed below.

1. All conclusion/interpretations must be cited. For example, if the site summary states "accidental releases of fuels and oils from tug operations are a direct pathway for contaminants to reach in-water media," the statement must be supported with a reference from which these conclusions were taken. In most cases assume the Summaries are only reporting facts in the site summaries, not drawing conclusions or making interpretations of the facts or data upon which those facts are based. Groundwater plume maps and discussions are the major exception. If the authors are making their own interpretations, this must be clearly stated. GW plume maps must provide the support for conclusions as per the *Plume Map Guidelines,* including COIs, basis for plume (e.g., detections, arbitrary concentration, screening level), who made the interpretation, and references.

2. If soil, groundwater, or other screening levels are used, they must be identified (e.g., AWQC, DEQ, DEQ 5x, etc) along with a reference to the report in which the screening was conducted. With the possible exception of groundwater plumes, the Summaries will not include screening unless it can be referenced.

3. All boxes in the Site Summaries must be marked. If the caption accompanied by a "yes" or "no" box is not applicable, indicate by marking the section "not applicable." Some text must accompany each box, even with "No" (i.e., No soil sampling was identified in the reports cited"). In addition, no subsections will be left blank. If no information is available, it should be stated.

4. The document must maintain the heading structure shown in the Site Summary. Template. This includes tables and figures. The standard and supplemental tables and figures are shown at the end of the Template.

SITE NAME
CSM Site Summary – [Appendix #]

SITE NAME

Oregon DEQ ECSI #: Some sites may have multiple numbers, list all with name if more than one.

[Address]
DEQ Site Mgr:
Latitude:
Longitude:
Township/Range/Section:

River Mile: xx East bank / West bank *[select one]*

LWG Member ☐ Yes ☐ No

Upland Analytical Data Status: ☐ Electronic Data Available ☐ Hardcopies only

Identify all parcels/properties/ECSI numbers that are presented in the site summary and why the ECSI numbers are lumped together. List each separate parcel in each subsection consistently. If no information for a particular parcel/property/ECSI numbers, then state so. Examples: Linnton Plywood/Columbia S&G, South Rivergate Industrial Park/Simplot, Front Ave. Properties/3 properties, RK Storage, Willbridge Term., Gasco/Koppers.

1. SUMMARY OF POTENTIAL CONTAMINANT TRANSPORT PATHWAYS TO THE RIVER

The current understanding of the transport mechanism of contaminants from the uplands portions of the site to the river is summarized in this section and Table 1 and summarized in following sections.

The discussions will include a brief description of sources and pathways with sediment and/or transition zone water as the receptor. The discussions and table (referring to Table 1) will differentiate current and historical pathways, if possible. Conclusions/interpretations, here (or in the supporting section) and in Table 1, require a citation. Current and historical sources must be discussed here or in supporting sections.

This introductory section may also introduce multiple ECSI sites, multiple properties, or divisions of the site covered with this Site Summary.

This section and supporting sections should cover both **current and historic** activities.

1.1. Overland Transport

Describes sheet flow or overland runoff that is documented of has the potential to transport contaminated soil or other materials to in-water media (sediments, surface water). Paved and unpaved sites may have sheet flow that discharges directly to the river over the bank or may be discharging to catch basins. Supporting information is provided in the Soils Nature and Extent subsection (Section 10).

1.2. Direct Discharge (Overwater Activities and Stormwater/Wastewater Systems)

Describes overwater activities (docks and transfer points), spills, and outfall discharges. This section should be supported by Section 8

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1.3. Groundwater

This section should provide a very brief description of the aquifer(s), flow direction, the presence or absence of a groundwater plume,(potentially including COIs by major groups[such as VOCs, PAHs, metals]), some description of the plume(s) extent (e.g., the VOC plume covers about ½ of the property), and whether this is a potential contaminant transport pathway to the river. In addition, to the extent known, groundwater related preferential pathways are briefly described (ABC consultant (1999) indicates that groundwater discharge is directed along a buried channel, or buried utility, toward the river near the center of the property).

The groundwater summary should be supported by Sections 9 and 10

1.4. Riverbank Erosion

Describes erosion of riverbank due to river flow, wave action, or overland runoff that is causing back erosion. This is of particular concern when the bank is contaminated. Information should be supported in Section 10.

1.5 Relationship of Upland Sources to River Sediments

In general, unless specifically addressed in a report or by DEQ/EPA Joint Source Control Program, this section will be updated in the final CSM. All conclusions require a citation.

1.6 Sediment Transport

This section will be completed by Integral and provides sediment transport information relative to Sediment Transport Analysis, Sediment Profile Images, and bathymetric surveys conducted by the LWG in the river.

2. CSM SITE SUMMARY REVISIONS

Date of Last Revision:

3. PROJECT STATUS

Primary Sources: ECSI file and DEQ Staff Report

Activity		Date(s)/Comments
PA/XPA	☐	
RI	☐	
FS	☐	
Interim Action/Source Control	☐	
ROD	☐	
RD/RA	☐	
NFA	☐	

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DEQ Portland Harbor Site Ranking (Tier 1, 2, or 3): This information is provided in GSI's Groundwater Data Review report, Table 4.2

4. SITE OWNER HISTORY

Primary Sources: ECSI file, RI reports, site investigation reports, and DEQ Staff Report.

Owner/Occupant	Type of Operation	Years

[Check to be sure Owner/Occupant information is presented in a consistent order.]

5. PROPERTY DESCRIPTION

This section should include information on acreage; topography; pavement, drainage, facilities (current and historical), storage tanks, other information relevant to pathways (utilities), surrounding land use type (e.g., mixed use, industrial, etc,), zoning, ownership, boundary information along riverfront Provide

Primary information source: RI or other document, ECSI database.

The following statement (or similar) should be included: Placeholder: DSL lease information on riparian areas and /or river bed.

6. CURRENT SITE USE

A summary of current site usage, general manufacturing processes, buildings and facilities, waste handling and storage, materials stored on the site, as applicable.

Primary data sources: RI or other document, ECSI database, aerial photos, include operations, products and chemical handling.

7. SITE USE HISTORY

This section should summarize the site use history as it applies to potential sources. A brief description of pre-development conditions (e.g., historical streams, fill placement) should be included. Historical information should include date(s) of initial development and a brief summary of major activities/operations, waste and product handling practices. Environmental activities (e.g., cleanups) not covered in other sections may be included here.

Primary data sources: RI or other document, ECSI database. Include: History of site usage, history of manufacturing, general history of chemical /manufacture/usage/management.

8. CURRENT AND HISTORIC SOURCES AND COPCS

This section deals with sources and COPCs with potentially complete pathways to the river to the extent these determinations can be made. The understanding of historic and current potential upland and overwater sources at the site is summarized in Table 1. The following sections should provide a brief overview of the potential sources and COPCs at the site.

There is no distinction in this section between COIs and COPCs as defined in the Oregon Risk Guidance. These sections should provide a brief discussion of the potential sources at the site requiring additional discussion, including information about source, mechanism, and timing of releases, to the extent known. Bulleted lists or imbedded tables are used as necessary.

Information sources in order of preference: RI or other documented investigation, DEQ Staff Report, DEQ or LWG member project manager, ECSI Database. Conclusions require a citation.

8.1. *Uplands*

Includes a brief descriptions of historic and current upland sources that parallels information summarized in Table 1. These typically include USTs, ASTs, waste and product storage and/or process areas, transformers, waste ponds, etc.

8.2. Overwater Activities ☐ *Yes* ☐ *No*

Check to be sure that either "Yes" or "No" is checked. If "Yes" or "No" is not applicable, say "Not Applicable" with an explanation below. If "No", an explanation should also be provided. If additional information is required, use "Placeholder" with an explanation.

These activities typically include docks, barge and vessel operations, pipelines, etc.

Placeholder: Information about the owner having and exercising a statutory right to an overwater facility

8.3. Spills

This section is usually a table (see below) following a typical introductory paragraph: "Known or documented spills at ___site were obtained either from DEQ SPINS database for the period of 1995 to 2003, from oil and chemical spills recorded from 1982 to 1989 by the U.S. Coast Guard and the National Response Center's centralized federal database [see Appendix E of the Portland Harbor Work Plan (Integral et al. 2004)], or from DEQ correspondence. These spills are summarized in the table below."

Information Sources: RI and other documents, Coast Guard Records, DEQ Water Quality Spill Records Include all overwater spills (liquid and solid materials) and known spills with complete pathway to sediments. Include major spills with potential to impact sediments.

Spills known to have been small in volume and/or had an appropriate response action, or can be characterized as overwater spills of highly soluble materials (e.g., do releases have potential to cause a measurable impact to inwater media if the pathway is complete?) are generally not included.

Date	Material(s) Released	Volume Spilled (gallons)	Spill Surface (gravel, asphalt, sewer)	Action Taken (yes /no)

9. PHYSICAL SITE SETTING

This section presents the physical setting (geology and hydrogeology) and conditions present at the site. The subsurface geologic deposits and the understanding of the aquifer or aquifers present beneath the site

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are presented. This information provides the physical system for the presentation of the nature and extent of contamination in Section 10.

In most cases, this introductory section should summarize/list the investigations that are used to support Sections 9 and 10.

Information Sources: GSI Groundwater Summary Report, RI and other documents. This is primarily non-interpretative data. For each of the categories in Sections 9, 10, and 11 either provide a list of the most significant reports having information relating to that specific topic or provide citations using standard reporting conventions. Citing references for Sections 9, 10, and 11 is critical. See section on supplemental figures and tables at end of template.

9.1. Geology

This is a general description of the near surface stratigraphy, regional geology is not generally covered in detail unless it has relevance. If available, a cross section(s) is presented at Figure 2 or as a supplemental figure(s). A small table should be included with the following information, if applicable:

- Number of test pits borings, explorations,
- historical features, fill areas, historic bankline.
- cross-sections *[Existing cross sections in GW report or in existing reports]*
- horizontal and vertical extent of subsurface geologic information investigated at the site

9.2. Hydrogeology

The shallow and deeper water bearing aquifers and aquitards are described, as applicable. A small table should include the following information:

- Identified water-bearing zones
  - Number of wells/zone
  - Groundwater flow direction/zone
- Horizontal & vertical gradients & velocity, if available
- Aquifer parameters, if available
- Seep Locations

Information sources: Seep Reconnaissance Report, Existing documentation, DEQ and LWG member project managers

10. NATURE AND EXTENT *(Current Understanding)*

The current understanding of the nature and extent of contamination for the uplands portions of the site is summarized in this section. When no data exist for a specific medium, a notation is made.

Information Sources by order of preference will be existing site investigation report, consultation with DEQ/LWG member project managers, and DEQ ECSI database and staff reports. <u>If screening criteria are referenced for any media type below, the criteria should be clearly identified and reference for who did the screening should be provided</u> (e.g., Soil concentrations were compared to DEQ Numerical Soil Cleanup Standards (DEQ 1994) by xx (1999)).

It is critically important that this section be properly referenced, including conclusions/interpretations made by the Site Summary authors.

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10.1. Soil

10.1.1. Upland Soil Investigations ☐ Yes ☐ No

Data from existing documents are summarized. Concentration ranges (max/min) or similar statistics may be provided in an imbedded table format. Scanned existing soil concentration maps and tables, if available, and provided in the supplements. These should be summary tables and maps, not a complete list of all data.

Overland transport/sheet flow should be discussed. Paved and unpaved areas should be differentiated.

Check to be sure that either "Yes" or "No" is checked. If "Yes" or "No" is not applicable, say "Not Applicable" with an explanation below. If "No", an explanation should also be provided. If additional information is required, use "Placeholder" with an explanation.]
Concentration ranges (Min/Max) should be proved in an imbedded table format. Scans of existing soil concentration maps, if available, are provided in attachments.

10.1.2. Riverbank Samples ☐ Yes ☐ No

Check to be sure that either "Yes" or "No" is checked. If "Yes" or "No" is not applicable, say "Not Applicable" with an explanation below. If "No", an explanation should also be provided. If additional information is required, use "Placeholder" with an explanation.

Data from existing documents is summarized, in an imbedded table, as appropriate.

10.1.3. Summary

This section provides a summary of soil data as it relates to potential contamination to in-water media. Examples include contaminated bank areas that may be eroding, surface soil that contributes to stormwater discharge or overland flow, subsurface soil contributing to groundwater contamination. If information is lacking for any particular subsection (e.g., data gaps), state that "No information is available for __ in the documents reviewed."
Please note, there will be very few instances, if any, when there is a enough information to conclude a connection between site soil and in-water media contamination. Statements that make or appear to make such a connect need to account for both current and historical conditions and be referenced to an outside source. The Site Summary authors will not be making these kind of statements.

10.2. Groundwater ☐ Yes ☐ No

Section 10.2 provides a current understanding of the nature and extent of groundwater contamination, if applicable for a site.

Check to be sure that either "Yes" or "No" is checked. If "Yes" or "No" is not applicable, say "Not Applicable" with an explanation below. If "No", an explanation should also be provided. If additional information is required, use "Placeholder" with an explanation.

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10.2.1.Groundwater Investigations ☐ Yes ☐ No

A brief discussion of the investigations to date should be presented, including dates, the general scope, number of wells, etc. The most recently reviewed report should be identified. This section should not include data recitals.

10.2.2.NAPL (Historic & Current) ☐ Yes ☐ No

A brief description of the distribution of NAPL (past and present) and the NAPL constituents should be presented.

10.2.3.Dissolved Contaminant Plumes ☐ Yes ☐ No

Plume characterization status – complete/incomplete

This should be a short statement on the status of the plume characterization. A plume is generally considered fully characterized if defined as such in an approved RI or similar document or by DEQ or LWG member project manager and the report must be cited. If necessary, provide separate statements for multiple aquifers.

Plume Extent

Briefly describes the nature and extent of the dissolved groundwater plume, if applicable. Multiple aquifers should be discussed and described. Data tables are not generally associated with this section.

The last subsection in Section 100.2.3 (Temporal Trends) should describe historical conditions if the nature and extent of the plume(s) have changed over time (e.g., pre- and post-remediation)

Min/Max Detections (Current situation)

A brief description of the most recent current groundwater data set available (including a list or description of the wells, if necessary), a reference, and an imbedded table with ranges in COI concentrations (e.g., Max/Min). This min/max table differs from the section below (Current Plume Data) in that it includes all site data from only the most recent sampling event(s). The section below presents only downgradient data.

Current Plume Data

This section is primarily a place to reference the plume map. In most cases the language should be similar to the following:

"Based on the data reviewed by GSI, the current dissolve groundwater plume data is shown on Figures 2 and/or 3."

Maps obtained from existing reports or in consultation with DEQ for LWG member project managers will be referenced as such in this section. Generated maps will depict the types of contaminants mapped (e.g., VOCs, PAHs, etc). A "plume basis box" should be present indicating the basis for the plume outline (e.g., detections, concentration

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contour, etc.) and constituents. A preference for monitoring well data will be given over Geoprobe or grab sample data at locations where both types of data exist.

The plume maps also show a dot(s) on the map representing the maximum concentration detected at the site (current and historic), and the date this sample was taken. If preferential pathways are present, this should be shown as an arrow on the map.

Preferential Pathways

Describes preferential groundwater pathways documented at the site. A preferential groundwater pathway may include either natural (i.e., erosional channels cutting across the site) or man made (i.e., utilities intercepting shallow groundwater) of preferential groundwater flow.

This section should include standard language when either "no review of preferential pathways has been conducted at the site in the documents reviewed" or if utilities are known to be present, but no information is available relative to preferential pathways (e.g., "Subsurface utilities are described in xx(1999) and include stormwater and product piping. However, no information has been presented regarding the depths of the utilities at the facility relative to the shallow groundwater table or if the utility and associated backfill may be a preferential pathway at the site.").

Downgradient Plume Monitoring Points (min/max detections)

A summary of the downgradient min/max concentration in either the most downgradient well or across a series of wells (i.e., wells along the top of the riverbank). The intention is to provide the min/max that represents both current and historic data as an imbedded table with Max/Min concentrations. The text should clearly identify the data set(s) used and who made the determination of which data set to use (in most cases, this will be GSI).

Visual Seep Sample Data ☐ Yes ☐ No

Describes observations and/or analytical data for seeps.

Typical information Sources: Seep Reconnaissance Survey Report and recent site reports. Describe the sample locations and results, if applicable

Nearshore Porewater Data

Describes the sample location and results, if applicable

Typical information sources: Seep Reconnaissance Survey Report and recent site reports.

GW Plume Temporal Trend

Historic and current trends should qualitatively discussed in this section. Information focus will be on data from pre- and post-remedial efforts, if applicable. Data summaries and plots of monitoring data will <u>not</u> be included.

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10.2.4.Summary

Provide a summary of groundwater conditions as it relates to potential transport of contamination to in-water media. Examples include flow direction, groundwater conditions at the river bank, known discharge points/areas, temporal and spatial trends in concentration distributions. If information is lacking for any particular subsection (e.g., obvious data gaps), state that "No information is available for __ in the documents reviewed.

Please note, there will be very few instances, if any, when there is a enough information to conclude a connection between site groundwater and in-water media contamination. Statements that make or appear to make such a connect need to account for both current and historical conditions and be referenced to an outside source. The Site Summary authors will not be making these kind of statements.

10.3. Surface Water

Outfall locations are provided in Figure 1 and in supplemental figures, as applicable. It is important to cross-reference unique site outfall names/numbers to the City's outfall numbers in parentheses (WR##).]

Check to be sure that either "Yes" or "No" is checked. If "Yes" or "No" is not applicable, say "Not Applicable" with an explanation below. If "No", an explanation should also be provided. If additional information is required, use "Placeholder" with an explanation.

10.3.1.Surface Water Investigation ☐ Yes ☐ No

This section introduces any site-specific stormwater/wastewater investigation OUTSIDE of standard general permit (e.g., 1200Z) stormwater monitoring. A reference is provided here along with a brief description of the study. Data are summarized in Section 10.3.3 and/or 10.3.6. If only general permit-holder monitoring is conducted, "No" is checked.

10.3.2.General or Individual Stormwater Permit (Current or Past) ☐ Yes ☐ No

This section covers stormwater permits, as opposed to wastewater permits discussed in Section 10.3.5. These permits are generally limited to DEQ 1200Z permits and COP/POP MS4 permits. In a few cases, stormwater permits are combined with wastewater permits and this should be explained in the text. In most cases, these storm water permits will be general, with a few exceptional individual permits.

For both the general and individual permits (current and historic), provide permit number and type,; describe the catchment area, attach map of stormwater system at site (if available), and differentiate between city and private outfalls. If historic or past permits exist for the site, include the following permit information: type, number, date first initiated, outfall ID, and parameters/frequency of analysis (see table below).

Permit Type	File Number	Start Date	Outfalls	Parameters/Frequency
1200Z	1234	4/4/99	WR-34	Standard[1]

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[1] Standard 1200Z permit requirements include pH, TSS, oil and grease, copper, lead, zinc, and visual monitoring. Frequency is twice per year. *This is an example.*

Do other non-stormwater wastes discharge to the system? ☐ Yes ☐ No

Industrial wastewater permits may discharge to permitted storm water. These should be briefly identified in this section with details in Section 10.3.5. The City of Portland may be providing information, as applicable, in their review of site summaries.

10.3.3. Stormwater Data ☐ Yes ☐ No

Summarize data for individual permit holders only in an imbedded table. Stormwater data for general permit holders will not be summarized.

Only summarize analytical data for individual permit holders – these are (as of 5/6/04) Ash Grove Cement (South Rivergate ECSI #), ATOFINA, Cascade General, Columbia River Sand & Gravel, Kinder Morgan Bulk Terminal, Koppers, OSM, Wacker Siltronics, Starlink Logistics (formerly Aventis), and 1 site without an ECSI number – Univar USA. Historic permit holders may be checked in DEQ's **Facility Profiler** or may need to be researched at DEQ, if so, state and indicate a placeholder.

10.3.4. Catch Basin Solids Data ☐ Yes ☐ No

Catch basin data should be summarized, if available

10.3.5. Wastewater Permit ☐ Yes ☐ No

If historic or past wastewater permits (e.g., boiler blow down, oil/water separator discharge, petroleum treatment discharge, cooling water) exist for the subject site, briefly describe (to the extent known) the waste water process, where the discharge is occurring and include the following permit information: type, number, date first initiated, the outfall ID, volumes, and required analyses.

Permit Type	Permit Number	Start Date	Outfalls	Volumes	Parameters/Frequency
GEN13	1234	4/4/04	WR-12	1000 gpd	Standard[1]

[1] Standard GEN13 permit requirements include flow and oil and grease. Total suspended solids, pH, copper, lead, zinc, ethanol and methyl-t-butyl ether (MTBE) may also be required. *This is an example.*

10.3.6. Wastewater Data ☐ Yes ☐ No

Summarize, if permitted. This data should either be an imbedded table or a supplemental table from existing reports.

10.3.7. Summary

Summary of stormwater conditions as it relates to potential transport of contamination to in-water media. Examples include known contaminated discharges to the river. If information is lacking for any particular subsection, state that "No information is available for __ in the documents reviewed.

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Please note, there will be very few instances, if any, when there is a enough information to conclude a connection between site surface water and in-water media contamination. Statements that make or appear to make such a connect need to account for both current and historical conditions and be referenced to an outside source. The Site Summary authors will not be making these kind of statements.

10.4. Sediment

Check to be sure that either "Yes" or "No" is checked. If "Yes" or "No" is not applicable, say "Not Applicable" with an explanation below. If "No", an explanation should also be provided. If additional information is required, use "Placeholder" with an explanation.

10.4.1. River Sediment Data ☐ Yes ☐ No

Integral will provide a sediment query of all sediment data between the site and the toe of the slope and within the site boundaries and provide summary statistics (Table 2). Identify the studies summarized in this section. Discussion items should include detected constituents and concentration ranges. Discussion may be limited to COPCs. This section is to be a brief and general discussion of the sediment chemistry data to date. There should be no references to individual stations or spatial relationships for this 1st update of the site summaries unless these discussions can be referenced to an existing report" Some of these sites have done their own sampling and reports provide discussions. These should be accompanied by supplemental tables and figures.

Information Sources: Weston, in-water site-specific site characterizations, and LWG's Portland Harbor database.

10.4.2. Summary

See final CSM update.

This section is expected to be a placeholder until RI data are evaluated unless a reference can be cited that covers both current and past issues. A discussion of what is known of the relationship between upland sources and sediment conditions will generally not be provided in this 1st update of the site summaries. If information is lacking for any particular subsection, state that "No information is available for __ in the documents reviewed.

11. CLEANUP HISTORY AND SOURCE CONTROL MEASURES

11.1. Soil Cleanup/Source Control

Brief summary of cleanup. If no cleanup has been conducted, indicate this. Any comments on the effectiveness of the cleanup should be cited.

11.2. Groundwater Cleanup/Source Control

Brief summary of cleanup. If no cleanup has been conducted, indicate this. Any comments on the effectiveness of the cleanup should be cited.

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11.3. Other

This should include items like removal of waste containers or drums, catch basin cleanup, etc.

11.4. Potential for Recontamination from Upland Sources

See final CSM update.

This section is expected to be a placeholder until RI data are evaluated. Possible exceptions will needed excellent and conclusive references.

BIBLIOGRAPHY / INFORMATION SOURCES

References cited
Other relevant references/information sources
Figures:

Figure 1 – (Provided by LWG) Site Features (aerial photo base with outfalls, beaches, Round 1, existing Category 1 & 2 data, planned Round 2 sediment sample locations). Label adjacent properties to the subject site.
Figure 2 – Cross Section (as available)
Figure 3 – Extent of Impacted Groundwater (as available)

- **Include basis for plume definition (detection limit, etc)**
- **Show max. concentration and date location**
- **Provide arrows or similar graphic that demonstrate understanding of groundwater pathway to the river (e.g., deflections around slurry wall, subsurface/buried channels, known discharge points)**

Tables:

Table 1: Potential Sources and Transport Pathways Assessment. ***Provide references for conclusory statements.***
Table 2: (Provided by LWG) Queried Sediment Chemistry Data (summary statistics only, Category 1 & 2 surface and subsurface data separated). Query boundaries are from site boundaries out to the toe of the channel slope. In Swan Island Lagoon and a few other locations, use best professional judgment. ***Qualifiers will be defined in a comprehensive list before all site summaries.***

Supplemental Scanned Figures:

Site map
Waste management units (grit piles, tanks, ponds, etc.)
Exploration locations
Soil & Groundwater Information
Source Control/ Remedial Action Information
Stormwater Information
Release Sources
Others as referenced in text

Battelle. 2002. Assessment of the Nature of PAH in Surface Sediments along the Southwestern Shore of Portland Harbor Superfund Site. Battelle Memorial Institute, Environmental Forensic Investigation Group, Duxbury, MA.

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DEQ. 2004. DEQ Site Summary Report – Details for Site ID ####. DEQ Environmental Cleanup Site (ECSI) Database. Accessed DATE. www.deq.state.or.us/wmc/ecsi/ecsidetail.asp?seqnbr=####.

DEQ. 1999. DEQ Strategy Recommendation – Name of site. Full date of SR. Site Assessment Program, Oregon Department of Environmental Quality, Portland, OR.

EDR. 2002. EDR Environmental Atlas, Portland Harbor, Multnomah. OR. Environmental Data Resources, Southport, CT.

Groundwater Solutions. 2003. Portland Harbor RI/FS: Upland Groundwater Data Review Report, River Mile 2-11, Lower Willamette River. Prepared for the Lower Willamette Group, Portland, OR. Groundwater Solutions, Inc., Portland, OR.

Integral. In preparation. Round 1 Site Characterization Report. Prepared for Lower Willamette Group, Portland, OR. Integral Consulting, Inc., Olympia, WA.

Integral, Windward, Kennedy/Jenks, Anchor Environmental, and Groundwater Solutions. 2004. Portland Harbor RI/FS Programmatic Work Plan. Prepared for the Lower Willamette Group, Portland, OR. Integral Consulting, Inc., Olympia, WA.

SEA and DEA. 2003. Lower Willamette River May 2003 Multibeam Bathymetric Survey Report. Prepared for the Lower Willamette Group, Portland, OR. Striplin Environmental Associates, Inc., and David Evans Associates, Olympia, WA.

Weston. 1998. Portland Harbor Sediment Investigation Report. Prepared for U.S. Environmental Protection Agency. Roy F. Weston, Inc., Portland, OR.

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Groundwater Plume Definition Guidelines

Groundwater Solutions Inc.
3758 SE Milwaukie Ave. Portland, Oregon 97202
ph:503.239.8799 fx:503.239.8940 e:groundwatersolutions.com

Memorandum

To: Lower Willamette Group

From: Walter Burt, R.G.

Date: May 17, 2004

Re: Guidelines for Depicting Areas of Groundwater Contamination, Conceptual Site Model Document, Portland Harbor Sediment RI/FS

Introduction

This memorandum summarizes guidelines for developing outlines of the area of groundwater contamination at upland sites for inclusion in the conceptual site model (CSM) document site summaries. The approach entails providing an interpretation of the areal (horizontal) extent of groundwater contamination based on a broad set of guidelines and including a portrayal or description of the level of uncertainty in the interpretation as a result of the type of data used and who does the interpretation.

The intent of the approach for developing these maps is to purposely leave the interpreter wide latitude on how the interpretation is made, as long as the key objectives of the maps are met and that the basis for the interpretation is provided. Note that this memorandum provides general guidelines, and that each site will have particular characteristics or issues that may not be covered here. Please do not hesitate to contact Walter Burt at Groundwater Solutions, Inc., (503) 239-8799, if you have any questions about how to handle a specific issue.

Key Objectives

The focus should be on showing the horizontal extent of groundwater contamination and the potential pathway(s) to the river. The maps will be used to assist in identifying where assessment of potential groundwater impacts to in-water media should be conducted, or in other words, where contaminated groundwater could reach the sediments or surface water in the river.

Key Elements

The key elements of each map showing the extent of groundwater contamination include the following:

- Map showing extent of areas of groundwater contamination by general chemical class and aquifer. Ideally, a separate area or plume attributable to a specific source area would be designated.
- Arrows or other marks showing general direction of groundwater flow or other indicator of where the groundwater pathway to the river may be complete
- The location of the focus of the plume (e.g., highest concentration) and date of sample

General Instructions

Each member will be provided with a Lower Willamette Group (LWG) aerial photo base map of their site and a table to be used to document the basis of the interpretation. The general process is as follows:

1. Delineate the outline of the plume on the LWG map of the site, or use your own existing site plan. It is important that if a map other than the supplied map is used, that the site boundaries and similar key features are shown on the map used so we have a reference to establish coordinates for the shape of the plume. Provide question marks where the extent is uncertain.
2. Delineate each area of affected groundwater based on the following general chemical categories:
    - Volatile organic compounds (VOCs)
    - Polycyclic aromatic hydrocarbons (PAHs)
    - Other semivolatile organic compounds (SVOCs)
    - Metals
    - Pesticides
    - Petroleum fuels
    - Other (e.g., perchlorate)
3. Provide the location and date of the highest concentration within a plume and the date the sample was obtained at that location. The purpose of this step is to provide a reference point for the current "center" of the plume.
4. Provide a summary of the basis for the interpretation by filling in the table.
5. Fax or send the copy of the map and fax or email the table to:
    Walter Burt
    Groundwater Solutions, Inc.
    3758 SE Milwaukie Avenue
    Portland, OR 97202
    wburt@groundwatersolutions.com

The plume outlines will be converted into GIS shape files with the appropriate pattern to indicate extent, and color to indicate the class of chemical as shown in the examples provided to the LWG and posted on the LWG Web site.

Criteria for Delineations

There are three possible methods available to LWG members for delineating an area of contaminated groundwater: (1) using a screening level criterion for the limit (e.g., 5x AWQC, MCL, etc.), (2) using an arbitrary concentration criterion (e.g., 100 ug/L, etc.), and (3) using a detect/nondetect criterion. Some of the issues associated with each of criterion are discussed in the following sections.

Screening Level Criterion

The primary limitation of using this method for delineating groundwater contamination is that many plumes involve more than one compound. It also may involve making professional judgments regarding which compound(s) among a suite is most important relative to the potential impacts to the river. Another limitation is that screening levels are not available for many petroleum fuel-related compounds. Guidelines for the type of information to provide if using a screening level criterion include the following:

- Document which screening criterion, for which compound(s), is being used to delineate the plume.
- For petroleum plumes, also show the extent of the area with petroleum in groundwater in addition to the area based on the screening level criterion.

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Arbitrary Concentration Criterion

An arbitrary concentration criterion also can be used, although the criterion should reasonably reflect the extent of contamination that may pose potential risk to in-water media and should reflect the quality of existing data (e.g., existing data may have high detection limits or include only a limited number of constituents; the depiction should reflect these factors). Some of the limitations of the screening criterion approach apply here also because many plumes involve multiple compounds. Important information to provide when using an arbitrary concentration criterion include:

- Document which concentration criterion, and for which compound(s), is being used to delineate the plume.

Detect/Nondetect (Use for Non-LWG Sites) Criterion

Important information to provide when using a detect/nondetect criterion include:

- Document which compound(s) is being used to delineate the plume.

Other Aspects

This section attempts to provide guidelines for addressing a number of site-specific factors that may complicate development of groundwater contamination maps.

Multiple Aquifers

Groundwater contaminants may be present in more than one hydrostratigraphic unit at a given site. This section provides guidelines for how to depict groundwater contaminants present in more than one aquifer.

- For plumes in different aquifers that do not overlap, provide an outline of each, or show a merged outline of both.
- Describe which contaminant is present in which aquifer in the comments section of the table.

Multiple Contaminants

Provide a plume outline for major chemical classes. The ideal situation is to provide a separate outline for each potential source area. However, this may not be practical in some cases. If multiple classes of contaminants in groundwater are commingled, draw a general outline of the affected area, designate the area according to one of the other chemical classes, and document which other chemical classes are present.

Transboundary Plumes

In some places, groundwater contamination crosses property boundaries, and/or the source of groundwater contamination on a site may result from offsite activities. It is important to show the known extent of the offsite plume. If an onsite plume results from offsite activities, provide text that describes this on the map legend and in the table.

Metals

This section provides guidelines determining whether and how metals detections should be used to depict areas of groundwater contamination.

- Delineate metals contamination only where associated with a definitive source of metals.
- Use only dissolved (filtered) metals results if both total and dissolved data are available.
- Metals detections that cannot be tied to a particular source, or are closely tied to another contaminant (e.g., arsenic mobilized by anoxic conditions within a petroleum plume) should not

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be depicted as separate plumes. However, the presence of the metals should be noted in the accompanying table.

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Table ___

Basis for Interpretation of Groundwater Contamination Extent

Portland Harbor Sediment RI/FS

Site Name	Author of Impacted Groundwater Extent Estimate	Date of Assessment	Contaminant Type	Minimum Isoconcentration Contour	Comments	References
ATOFINA Chemicals	ERM	2/5/2004	chlorobenzene	100 ug/L	Groundwater chlorobenzene data collected beneath the River has not been coordinated with the upland groundwater data.	Upland RI Report, Lots 3 and 4, Tract A (ERM, 2004)
			chromium	1,000 ug/L	Six data points were used to estimate the extent of chromium impacted groundwater.	
			perchlorate	1,000 ug/L	Groundwater perchlorate data collected beneath the River has not been coordinated with the upland groundwater data.	
Linnton Plywood (Columbia River Sand & Gravel)	Groundwater Solutions, Inc.	4/20/2004	petroleum related	MDL	Several isolated area of petroleum related compounds were identified. The groundwater sample collected near the maintenance shop is probably not isolated based on relatively high concentrations of diesel.	Pre-RI Assessment Report (CH2MHill, 2002)
			SVOC (bis(2-Ethylhexyl)phthalate)	MDL	The SVOC plume located in the southern portion of the site carries a high level of uncertainty due to the lack of data. The distribution of impacted groundwater is interpreted to be continuous based on past practice activities in the area.	
Mobil Oil Terminal	Groundwater Solutions, Inc.	4/20/2004	petroleum related	MDL	Groundwater petroleum plume in shallow aquifer is well defined through >50 fifty wells. Dissolved metals plume mimic TPH plume shape, indicating it is likely mobilization of naturally occurring metals by the TPH plume.	DEQ ROD (1997) Focused Feasibility Study (2003)

Notes:
MDL: method detection limit
ug/L: micrograms per liter
SVOC: semivolatile organic compound

Appendix A-1

ARCO Bulk Terminal

ARCO BULK TERMINAL
CSM Site Summary – Appendix A-1

ARCO BULK TERMINAL (TERMINAL 22T)

Oregon DEQ ECSI #: 1528

9930 NW St. Helens Road
DEQ Site Mgr: Thomas Gainer
Latitude: 45.593°
Longitude: -122.77°
Township/Range/Section: 1N/1W/2

River Mile: 4.9 West bank

LWG Member ☐ Yes ☒ No

Upland Analytical Data Status: ☐ Electronic Data Available ☒ Hardcopies only

1. SUMMARY OF POTENTIAL CONTAMINANT TRANSPORT PATHWAYS TO THE RIVER

The current understanding of the transport mechanism of contaminants from the uplands portions of the ARCO site to the river is summarized in this section and Table 1, and supported in the following sections.

1.1. Overland Transport

Overland transport of sheet runoff from the uplands to the river is minimal at this site as all stormwater is either directed to the stormwater system or directly infiltrates the ground (in the tank farm areas).

1.2. Riverbank Erosion

A concrete seawall and apron span the 800-foot river frontage. Boulder and concrete riprap underlie the toe of the seawall. At low tides, portions of the shoreline mudflats are exposed (SECOR 2002). Soils samples collected by URS within the smear zone beneath and shoreward of the sea wall (2004a,b) found benzene, benzo(a)pyrene, and arsenic concentrations that exceeded EPA Region 9 PRGs for industrial soil (URS 2004b), as well as concentrations of TPH (as gasoline, diesel and heavy oil). Due to the presence of the seawall, riverbank erosion is expected to be minimal.

1.3. Groundwater

Shallow groundwater discharges to the river from the site. A buried erosional channel filled with sand and gravel, which is more permeable than the surrounding material, bisects the site from west to east near the middle of the site (see Figure 2). This channel is a natural preferential groundwater discharge pathway to the river for groundwater. An existing groundwater and product recovery system generally contains the LNAPL plume discharging to the river. The plans for a new, more robust groundwater and LNAPL recovery system currently are being finalized for installation in the fall of 2004.

1.4. Direct Discharge (Overwater Activities and Stormwater/Wastewater Systems)

Stormwater is routed to a carbon treatment system and oil/water separator before being discharged through two NPDES-permitted outfalls on the Willamette. Treated groundwater is discharged through one NPDES-permitted outfall to the river. Stormwater infiltrates into the ground in the tank farms. Fuel transfer activities at the dock may directly contribute contaminants to in-water media (SECOR 2002; GSI 2003). There have been several documented overwater spills at this facility (see Section 8.3 below). Since 2003, there have been seven "incidents" of oil sheens within the permanent boom area on the Willamette River.

1.5. *Relationship of Upland Sources to River Sediments*

See Final CSM Update.

1.6. *Sediment Transport*

The ARCO Bulk Terminal is located on the west bank of the river at the upstream edge of a channel area characterized as transitional between an upstream transport zone (RM 5-7) and a downstream depositional zone (RM 1-3) (Integral et al. 2004). The riverbed at this site drops sharply from the shoreline to full channel depth just offshore along riverside of the dock. The Sediment Trend Analysis® results suggest that this river reach periodically experiences both net accretion and net erosion along the western portion of the channel and is in dynamic equilibrium in the center and eastern portions of the channel. The time-series bathymetric change data over the 25-month period from January 2002 through February 2004 (Integral and DEA in prep.) show a large region of sediment accretion (with some deposits greater than 2 feet in extent) around and immediately offshore of the ARCO dock extending down to about the –30 foot NAVD88 contour. Conversely, there is a roughly circular area of net erosion centered on the –30 foot NAVD88 contour just downstream of dock near the downstream edge of the ARCO property. Further downstream of this scoured area, the channel toe and slope area is again depositional (e.g., off of Linnton Plywood). The origin of this isolated scour area is unknown, but it is possibility related to ship traffic.

2. CSM SITE SUMMARY REVISIONS

Date of Last Revision: September 15, 2004

3. PROJECT STATUS

Activity		Date(s)/Comments
PA/XPA	☒	Geraghty & Miller (1994)
RI	☒	Final RI submitted to DEQ on October 3, 2002 (SECOR 2002), Final Addendum (URS 2003b)
FS	☐	
Interim Action/Source Control	☒	1) Installation product interceptor wells in 1971, with additions in 1994. 2) Contaminated soil removals in early 1990s. 3) Upgrading and overhaul of groundwater containment system planned for summer 2004 (URS 2004a,b).
ROD	☐	
RD/RA	☐	
NFA	☐	

DEQ Portland Harbor Site Ranking (Tier 1, 2, or 3): 1

4. SITE OWNER HISTORY

Sources: SECOR 2000, 2002, URS 2003b, DEQ 2004, Polk City of Portland directories, Sanborn Fire Insurance Map, Multnomah County Assessment and Taxation, USACE Port Series Report, hydrographic *maps and aerials.*

Owner/Occupant	Type of Operation	Years
Parcel A		
Richfield Oil/ARCO/BP	Petroleum storage and distribution	1926 - present
Linnton Realty Company	Real estate company	Unknown - 1926
Parcel B		
Richfield Oil/ARCO/BP	Petroleum storage and distribution	1939 - present
Signal Oil and Gas Co.	Petroleum storage and distribution	1937 - 1939
Liberty Petroleum Co.	Petroleum storage and distribution – unclear if in operation	Unknown - 1937
Supple & Martin Shipyard	Wooden vessels and barges shipbuilding	1920 - unknown
Columbia Engine Works	Wooden shipbuilding company	1917 - unknown
Parcel C		
Richfield Oil/ARCO/BP	No petroleum storage or dist. on this parcel (lot 300)/Lot 500	1956 - present/1939 - present
Various individuals	Residential	1952 - 1956
Pittsburgh Development	Unknown	1947 - 1952
Clark & Wilson Lumber	Lumber company	Prior to 1940 - 1947
Signal Oil & Gas Co.	Lot 500 - Petroleum storage and distribution	Unknown - 1939
Parcel D		
Richfield Oil/ARCO/BP	No petroleum storage or dist. on this parcel	1967 - present
State of Oregon	Unknown	Late 1950s/60s - 1967
Mobil Oil (lessee)	Warehouse	Unknown - 1967
Playcraft Products Co. (operator)	Toy manufacturing	~1947 - 1950
Gunderson Bros. Engineering Corp. (operator)	Unknown (plant)	~1944

5. PROPERTY DESCRIPTION

The ARCO Terminal 22T is located on the western shore of the Willamette River at approximately RM 4.9. The 14.21-acre site includes multiple tax lots in four parcels (Parcels A through D on Figure 1) and is bisected by railroad tracts and NW Linnton Lane. The site and surrounding areas are zoned for heavy industrial uses (DEQ 2004). The site is bordered by Exxon/Mobil Bulk Terminal to the east, Highway 30 to the west, and Linnton Plywood to the north (Figure 1).

The ARCO terminal consists of an operating bulk fuel storage terminal with 27 aboveground storage tanks (ASTs) (containing gasoline, diesel, lube oil and additives) located in three tank farm areas, as well as a remanufacturing warehouse (not in use), office and shop buildings, and a truck-loading facility. The site also includes a wharf on the Willamette River with an associated building. The south tank farm includes eight ASTs, the lube oil tank farm includes seven ASTs, and the north tank farm includes 12 ASTs. The truck and rail-spur loading racks are located on the western side of the property. The three tank farms are surrounded with dike walls. An 800-foot concrete seawall is located along the river (see Figure 1). Concrete riprap and rubble underlie the toe of the seawall (SECOR 2002), and portions of the shoreline mudflats are exposed at low tide.

The site is generally flat (approximate elevation of 32 feet above mean sea level) with a slightly upward slope to the west, toward St. Helens Road, and a slight downward slope toward the river. With the exception of rail spur areas and exposed areas within the tank farm, the terminal surface is covered with buildings, asphalt, gravel, or concrete. The lubricating oil tank farm is paved (SECOR 2000, 2002). Stormwater is routed to an oil/water separator and discharged either to the sanitary sewer or to the Willamette River under an NPDES permit, as described further in Section 10.3.

Information regarding the lease of submerged land was not provided by the Oregon Department of State Lands.

6. CURRENT SITE USE

The ARCO terminal receives, stores, blends, and transfers petroleum products. Petroleum products are delivered to the site via marine vessels, railroad tank cars, and pipeline. Products are distributed by marine vessels, tank cars and trucks, and pipeline. There is no manufacturing or refining at this facility. The majority of site operations occurs on Parcels A and B. The ARCO facility is designated a large-quantity generator under RCRA for storage and transport of hazardous waste (DEQ 2004).

7. SITE USE HISTORY

Portions of the property have been used for petroleum storage and distribution since before 1937. However, Sanborn Fire Insurance Maps indicate various activities have occurred on Parcel A (west of the railroad tracks), including a foamite plant in the 1920s (two ASTs and a pump house) at the location of the boiler site, and Parcel D (west of the railroad tracks), including toy manufacturing and the site of an engineering plant (activities unknown) in the 1940s. The toy manufacturer consisted of an office, boiler room, paint room, woodworking building, three warehouses and a drum washing area. Photographs (reviewed by Integral) show the waterfront portion of the site as a petroleum storage terminal with both the northern and southern tank farms and office buildings in their present locations in the 1940s. Storage capacity at the terminals has increased over time. A lube oil tank farm was added prior to 1969 (SECOR 2000). The wharf was constructed in 1993, at which time dredging occurred in this area (SECOR 2002).

Between 1942 and 1945, ARCO constructed a concrete seawall adjacent to the Willamette River waterfront as a source control measure. Later in 1968, they performed several process improvements to protect the river from contamination, including constructing a stormwater collection system and adding two oil-water separators. By 1971 additional storm drainage systems and four interceptor wells were installed. Two more interceptor wells were installed in 1994 (SECOR 2000).

ARCO reported a leak in a buried diesel pipeline in July 1991. In response, ARCO's contractor recovered 750 gallons of product from a sump installed around the piping repair. In 1993, about 1,800 tons of petroleum-contaminated soil were removed from the site, including the areas around the 1991 diesel release, the 1992 construction of a new railroad spur, the 1992 trenching for a new pipeline, and the December 1992 removal of a waste oil tank. Also in 1993, Geraghty & Miller (G&M) installed five monitoring and two recovery wells onsite. In Well P-11, G&M measured a free-product thickness of up to 12.42 feet. All four interceptor wells contained free product, ranging from 0.85 to 1.7 feet (DEQ 2004). Recovery of product from these wells continues to this day.

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8. CURRENT AND HISTORIC SOURCES AND COPCS

The understanding of the historic and current potential upland and overwater sources at the site is summarized in Table 1. The following sections provide a brief overview of the potential sources and COPCs at the site requiring additional discussion.

8.1. Uplands

During historical operations, periodic releases of product from underground pipelines, tanks, and during product transfer occurred, contaminating surface and subsurface soil and groundwater. These activities occurred in the truck-loading rack area, remanufacturing warehouse, and storage and transfer operations areas.

The following is a summary of the known and potential sources that have been identified at the ARCO site (SECOR 2002):

- 1991 diesel pipeline leak
- The truck-loading rack and the lube oil tank farm
- Storage and transfer operations areas
- The remanufacturing warehouse
- The southern tank farm and adjacent to the terminal seawall (based upon the presence of weathered diesel product and dissolved PAH/BTEX groundwater plume).
- Stormwater runoff that discharges through the outfalls. These contributions would be expected to be greater historically, prior to treatment system installation.

COPCs for the ARCO terminal include TPH, petroleum-related VOCs, PAHs, and metals (e.g., arsenic, chromium, copper, and lead) (SECOR 2002; URS 2003b).

8.2. Overwater Activities ☒ Yes ☐ No

Fuel transfer activities at the dock due to spills and leaking pipelines may be a source of sediment contamination.

8.3. Spills

Known or documented spills at the Marine Finance site were obtained either from DEQ's Emergency Response Information System (ERIS) database for the period of 1995 to 2004, from oil and chemical spills recorded from 1982 to 2003 by the U.S. Coast Guard and the National Response Center's centralized federal database [see Appendix E of the Portland Harbor Work Plan (Integral et al. 2004)], from facility-specific technical reports, or from DEQ correspondence. These spills are summarized below:

Date	Material(s) Released	Volume Spilled (gallons)	Spill Surface (gravel, asphalt, sewer)	Action Taken (yes/no)
7/12/91	Diesel	750	Soil	Yes
5/4/95	Gasoline	20 released, unknown amount in river	River	Yes
6/30/95	Diesel	Unknown	Unknown	Unknown
8/10/95	Gasoline	2	River	Yes
12/18/95	Diesel	Unknown	Boom area	Unknown
12/16/96	Heavy fuel oil	Unknown	Unknown	Unknown
12/3/98	Unknown	20	Asphalt, some entered floor drain	Unknown
12/12/03	Oil	Unknown	Boom area	Yes
1/13/03	Diesel	5	River	Yes
April 2003	Oil	April release followed by observations of very small quantities "blurbs of oil" rising inside of permanent boomed area	River	Yes

9. PHYSICAL SITE SETTING

Numerous subsurface explorations have been completed at the ARCO site since the early 1970s. The following information on the conceptual geologic and hydrogeologic site model is summarized from subsurface investigations reports prepared for the site, primarily the RI (SECOR 2002) and investigations associated with the source control measures (SCM) investigations (URS 2002, 2003a, 2004a).

9.1. Geology

Results from the subsurface borings indicate that the general site stratigraphy from the ground surface downward consists of the following (URS 2004b):

- Recent fill (consisting of sand, sandy gravel and cobbles, and/or gravelly sand and contains some debris)
- Pleistocene-Recent alluvium beneath the fill material is present in two predominant layers; a fine-grained alluvium and a sandy alluvium. The fine-grained alluvium layer directly beneath the fill consists of fine-grained silts and lean clay with interbeds of silty sands. This layer is approximately 10 to 15 feet thick and could be considered an aquitard. The top of the silt layer slopes from near the ground surface at the railroad tracks to beneath the river level to the east. Supplemental Figures 4-4 through 4-7 (URS 2004b) show that the seawall is generally not keyed into the silt layer. A buried erosional channel is present, cutting west to east across the middle of the site. This channel cuts into the fine-grained alluvium layer, but it is unclear if the channel cuts through the silt layer into the sand alluvium below. A contour of the base of the fill showing the channel is shown in Supplemental Figures 4-8 from URS (2004b). This erosional feature has been filled with coarser material (sand and gravel) (URS 2004b).

  The sandy alluvium beneath the silts is sandy material with silt interbeds. This sandy alluvium continues to the top of the bedrock.
- Columbia River Basalts were encountered at depths of between 40 feet bgs in the

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western part of the site and 70 feet bgs near the seawall (URS 2004b).

The edge of the site along the river is a concrete wall with riprap at the base of the wall. At low river stage, a shallow beach surface emerges at the river's edge below the riprap and wall structure.

The stratigraphy at the site is depicted in the generalized cross-section (see Figure 2) and in Supplemental Figures 2-2 and 4-1 through 4-7 from URS (2004b).

9.2. *Hydrogeology*

A shallow aquifer is present in the fill and the sandy alluvium on the eastern portion of the site where the aquitard may be missing. The fine-grained alluvial deposits act as an aquitard beneath the fill in the western portions of the site [see Supplemental Figure 5 from URS (2004b)]. There are two distinct hydrostratigraphic zones within the fill: the permeable material in the narrow filled channel, and the fill materials outside of the channel.

Seasonal fluctuations in groundwater levels of 8 feet have been documented in monitoring wells. Water levels at the site appear to be influenced by the presence of the seawall, which borders the eastern side of the site along the Willamette River, and the Willamette River stage. Tidal and river stage fluctuations are clearly evident in water level measurements within coarser channel deposit monitoring wells landward of the seawall (SECOR 2002; URS 2004b).

The overall long-term groundwater flow direction is east toward the Willamette River [see Supplemental Figures 4-11 and 4-12 from URS (2004b)]. Aquifer tests were completed at the site to determine the transmissivity of the hydrostratigraphic units of the shallow aquifer: the coarser-grained channel fill material, the finer-grained alluvium, and the sandy alluvium deposit. The following is a summary of the shallow aquifer information obtained from the RI report (SECOR 2002) and the SCM Basis of Design report (URS 2004b).

<u>Shallow Alluvial Aquifer</u>	
Number of Wells	~ 49
Groundwater Flow Direction	Overall direction is toward the east, toward the Willamette River.
Horizontal Gradient (average)	0.05 linear foot per foot (2000 data set) Flatter gradients in the coarse channel deposits = 0.01 foot per foot
Hydraulic Conductivity (K)	
Channel Deposit	33 to 100 ft/day
Fine-grained Alluvium	~ 0.5 to 2 ft/day
Sandy Alluvial Deposits	~ 1 to 2 ft/day
Transmissivity (T)	
Channel Deposit	1,800 to 3,200 ft^2/day

Recharge to shallow groundwater at the site appears to occur primarily from precipitation that infiltrates to the west of the site along the base of the Portland Hills. Also, infiltration of surface water through exposed onsite soils probably contributes to shallow groundwater recharge in some areas of the site.

Minimal monitoring of deeper portions of the shallow aquifer has been conducted. ARCO is installing several multiple-port piezometers along the top of the riverbank during the upgrading of the groundwater and product recovery system planned for installation in the fall of 2004 (URS 2004b) to assess the deeper parts of the aquifer and the vertical extent of impacts.

Seep Locations. Groundwater seeps through cracks in the seawall were identified at the site by the iron staining and wet appearance above the high-water mark (GSI 2003; URS 2004b).

10. NATURE AND EXTENT *(Current Understanding)*

The current understanding of the nature and extent of contamination for the uplands portions of the site is summarized in this section. As noted above, environmental investigations have focused on the portion of the site east of the railroad tracks. When no data exist for a specific medium, a notation is made. A RI has been conducted for the subject site that defined the nature and extent of contamination and included human health and ecological risk assessments (SECOR 2002). Besides ongoing definition of the extent of contamination extending offsite to the north, the extent of petroleum contamination has been defined in soil and groundwater.

10.1. Soil

10.1.1. Upland Soil Investigations ☒ Yes ☐ No

Approximately 125 soil samples were collected during the RI (SECOR 2002) and analyzed for TPH, PAHs, and total arsenic, cadmium, copper, and lead. Minimum and maximum concentrations are provided below:

Analyte	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Total Petroleum Hydrocarbons (TPH)		
TPH-G	4.42	8,380
TPH-D	<25	84,300
TPH-Dx (Heavy Oil Range)	<50	10,200
Polycyclic Aromatic Hydrocarbons (PAHs)		
Acenaphthene	<0.1	14.2
Acenaphthylene	<0.1	0.433
Anthracene	<0.1	15.4
Benzo(a)anthracene	<0.1	27.8
Benzo(a)pyrene	<0.1	22.4
Benzo(b)fluoroanthene	<0.1	20.1
Benzo(k)fluoroanthene	<0.1	17.4
Chrysene	<0.1	31.8
Dibenzo(a,h)anthracene	<0.1	4.18
Fluoranthene	<0.1	67.7
Fluorene	<0.1	18.5
Naphthalene	<0.1	61.8
Phenanthrene	<0.1	76
Pyrene	<0.1	63
Volatile Organic Compounds (VOCs)		
Benzene	<0.1	11.7
Toluene	<0.1	2.68
Ethylbenzene	<0.1	22.7
Total Xylenes	<0.2	31.6
1,2,4-TMB	<0.1	47.8
1,3,5-TMB	<0.1	13.8
n-Propylbenzene	<0.1	89.2
n-Butylbenzene	<0.5	26.1
Metals (total)		
Arsenic	0.926	87.6
Cadmium	<0.05	4.5
Chromium	<0.05	163
Copper	<0.05	8,650
TCLP Copper	0.2 mg/L	33.4 mg/L
Lead	<0.01	1,430
TCLP Lead	0.253 mg/L	4.93 mg/L

mg/kg = milligrams per kilogram (ppm)
mg/L = milligrams per liter

During the RI (SECOR 2002), the highest TPH-diesel concentrations were found at sampling depths greater than 16 feet (up to 84,300 mg/kg at GP-30) and occurred in a roughly triangular-shaped area underlying the lube oil tanks, truck-loading rack, and the eastern part of the south tank farm [see Supplemental Figure 13 from SECOR (2002)]. Diesel- and gasoline-range TPH are present in soils at depths up to 30 feet. Thirteen VOCs were detected in soil. Benzene was found as high as 11,700 µg/kg in 15- to 16-foot sample at GP-30, adjacent to the truck-loading rack [see Supplemental Figure 17 from SECOR

(2002)]. Of the carcinogenic PAHs detected, benzo(a)pyrene was detected in 75 out of 151 soils samples submitted for PAH analysis. The highest concentration, 22,400 μg/kg (7-8 feet at GP-35), was found at the northeast corner of the north tank farm [see Supplemental Figure 20 from SECOR (2002)]. Arsenic was detected in all soil samples, with the highest concentrations found in the northwest corner of the north tank farm, the truck-loading rack, the lube oil tank farm and the western half of the site (SECOR 2002).

During the SCM investigation (URS 2004a,b), Geoprobe® samples were collected in the northeast and southeast corners of the site. One soil sample was collected in the vadose zone in each Geoprobe® boring and was analyzed for TPH, VOCs, PAHs, and total and dissolved metals. Diesel-range TPH was detected as high as 8,290 mg/kg in a sample collected from the southeast corner of the site [see Figure 3 from URS (2004b)]. N-butylbenzene and n-propylbenzene were detected as high as 17.6 and 20 mg/kg in samples collected in the northeast corner. The highest concentration of arsenic (42.7 mg/kg) was found in a sample from the northeast corner of the site (URS 2004b).

10.1.2. Riverbank Samples ☒ Yes ☐ No

During the SCM Investigation (URS 2004a,b), soil samples were also collected along the seawall (revetment samples) (URS 2004a,b). One soil sample was collected at each location in the interval between the high and low water tables (i.e.. the hydrocarbon smear zone). Minimum and maximum soil concentrations for the SCM investigation are provided below:

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Analyte	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Total Petroleum Hydrocarbons (TPH)		
TPH-G	<4	2,700
TPH-D	<25	2,940
TPH-Dx (Heavy Oil Range)	<50	744
Polycyclic Aromatic Hydrocarbons (PAHs)		
Acenaphthene	<0.1	1.44
Acenaphthylene	<0.1	ND
Anthracene	<0.1	0.52
Benzo(a)anthracene	<0.1	1.12
Benzo(a)pyrene	<0.1	1.18
Benzo(b)fluoranthene	<0.1	1.13
Benzo(g,h,i)perylene	<0.1	0.87
Chrysene	<0.1	1.18
Dibenzo(a,h)anthracene	<0.1	ND
Fluoranthene	<0.1	1.61
Fluorene	<0.1	1.87
Naphthalene	<0.1	ND
Phenanthrene	<0.1	2.48
Pyrene	<0.1	1.71
Volatile Organic Compounds (VOCs)		
Benzene	<0.1	1.54
Toluene	<0.1	0.12
Ethylbenzene	<0.1	0.485
Total Xylenes	<0.2	0.792
Naphthalene	<0.1	0.0483
1,2,4-TMB	<0.1	0.235
1,3,5-TMB	<0.1	0.29
n-Propylbenzene	<0.1	6.44
n-Butylbenzene	<0.5	6.11
MTBE	<0.1	ND
Metals		
Antimony	<2	0.214
Arsenic	3.15	13.2
Chromium	11.5	20.3
Copper	17	355
Lead	6.31	262

mg/kg = milligrams per kilogram (ppm)

The highest TPH concentrations were found at sample locations REV-2 and REV-3 along the seawall, as shown in Supplemental Figure 3 from URS (2004b). These samples were collected by drilling through the seawall and collecting samples beneath and shoreward of the wall. Three constituents, benzene, benzo(a)pyrene, and arsenic, exceeded EPA Region 9 industrial soil PRGs in revetment soil samples collected during the CSM investigation (URS 2004b).

10.1.3. Summary

RI soil sampling confirmed that petroleum fuel released at the site has impacted fine-grained native soils and channel fill deposits (SECOR 2002), especially at sampling depths greater than 16 feet, which is generally consistent with the groundwater smear zone. Impacted subsurface areas include the 1991 pipeline leak area, lube oil tank farm, truck-loading rack, and the eastern part of the south tank farm.

During the SCM investigation (URS 2004a,b), benzene, benzo(a)pyrene, and arsenic exceeded EPA Region 9 PRGs in samples collected within the smear zone along the sea wall.

10.2. Groundwater

10.2.1. Groundwater Investigations ☒ Yes ☐ No

ARCO began conducting groundwater investigations at the site in the early 1970s. Historical releases of petroleum products, likely including but may not be limited to the truck-loading racks and a diesel product pipeline leak in 1991 near the truck loading rack, have resulted in an accumulation of liquid phase hydrocarbons or LNAPL floating on the water table and a dissolved phase petroleum plume. LNAPL product consists of relatively weathered and unweathered diesel product. A groundwater containment system was installed to contain free product and prevent it from reaching the river in 1971. Additional monitoring wells and groundwater/product extraction wells were installed in 1991, 1993, 1994, 1997, and 2001.

The focus of past environmental work at the site has been on the investigation, containment, and recovery of LNAPL. Investigation of the dissolved petroleum groundwater plume has been conducted at the site since the mid-1990s. The following summary represents the groundwater data set presented in the 2002 RI Report (through July 2002) (SECOR 2002) and the SCM data set along the seawall in July-August 2003 (URS 2004b). Locations of monitoring wells and borings installed since 2002 are shown in Supplemental Figure 2 from URS (2004b).

10.2.2. NAPL (Historic & Current) ☒ Yes ☐ No

Petroleum product has been observed in the following wells:

MW-1	MW-2	MW-3	MW-7
MW-8	MW-9	MW-10	MW-11
MW-12	MW-13	P-7	P-8
P-9	P-11	P-12	P-13
P-14	P-16	P-17	RW-1
RW-2	IW-1	IW-2	IW-3
IW-4	IW-5	IW-6	SC-1
SC-2	DW-1	DW-2	

The LNAPL at the site is concentrated in the course-grained channel fill material. LNAPL thicknesses have been greatest in wells MW-7, MW-8, RW-2, and P-11 [see Supplemental Figure 9 from SECOR (2002)]. The greatest thickness measured in wells at the site was 17 feet in MW-1 in March 1996 (SECOR 2002). Recent product sample testing indicates that the current product consists of unweathered and weathered diesel.

ARCO installed the groundwater interceptor well system (IW series of wells) in 1971 to reduce migration of petroleum product to the river. Product skimmers have been operating in the six interceptor wells. This system was expanded to include additional LNAPL recovery wells in 1994 (IW-5 and IW-6) and in 1997 (RW-1 and RW-2). LNAPL was reported seeping to the river when the recovery system went down (URS 2004b). This system is being upgraded and overhauled in the summer of 2004 to more completely prevent liquid and dissolved-phase petroleum from migrating to the river (URS 2004b).

The LNAPL recovery system collects, on average, approximately 200 gallons of product per month during the summer and approximately 500 gallons per month during the fall and winter (URS 2002). Between 1997 and 2003, about 7,800 gallons/year of petroleum product had been recovered from the subsurface. Using new wells and mobile pumping systems, recent recovery rates have improved. About 13,000 gallons of product were recovered in 2003 (URS 2004b). The volume of product collected is directly related to water table elevations. Improvements in the recovery system resulted in the recovery of approximately 3,000 gallons in June 2004 (Gainer 2004, pers. comm.).

Total LNAPL in the subsurface beneath the subject site recently was estimated at about 250,000 gallons, with about 133,000 to 185,700 gallons estimated as recoverable NAPL (URS 2004b)

10.2.3. Dissolved Contaminant Plumes ☒ Yes ☐ No

A dissolved gasoline and diesel petroleum hydrocarbon plume is present in the shallow aquifer beneath the site.

Plume Characterization Status ☐ Complete ☒ Incomplete

The RI presents the nature and extent of groundwater contamination at the site, and the SCM investigation provides additional details primarily along the river's edge (SECOR 2002; URS 2004b). DEQ approved the October 2002 RI Report and the May 2003 RI Addendum as complete with the condition that a second RI addendum evaluating the extent of subsurface contamination at the northern and southern property boundaries be submitted in the future (DEQ 2003b). This report is expected to be submitted in the fall of 2004 (Gainer 2004, pers. comm.).

In addition, to assess the vertical extent of impacts, ARCO is installing several multiple-port piezometers along the top of the riverbank during the upgrading of the groundwater and product recovery system, which is planned for installation in the fall of 2004 (URS 2004b).

Plume Extent

A floating LNAPL plume and dissolved-petroleum hydrocarbon plume are present in the shallow aquifer beneath the site. In general, TPH, PAHs, SVOCs, metals, and VOCs relating to release of petroleum hydrocarbons have been detected at various borings and groundwater monitoring wells at the site. Deeper groundwater investigations are being planned to verify the vertical extent of the dissolved plume [see Supplemental Figure 8 from URS (2004b)].

The shallow dissolved groundwater plume extends from the truck-loading rack on the western portion of the site to the river to the east [see Figure 3; based on Supplemental Figure 7 from URS (2004b)]. The groundwater/product extraction system captures a majority of this shallow free product and a portion of dissolved-phase groundwater plume before it discharges to the river. The lateral extent of the plume to the north and to the south is currently being evaluated by ARCO and will be presented in a second RI addendum.

The main part of the dissolved-petroleum hydrocarbon groundwater plume is beneath and near the LNAPL plume at the site [see Supplemental Figure 35 from SECOR (2002)].

This area corresponds to the coarser-grained buried channel that cuts west to east across the site. Elevated dissolved metals concentrations associated with petroleum releases closely mimic the TPH plume shape.

The nature and extent of the groundwater plume at the adjacent Mobil site will be monitored further during implementation of the SCM at the site (URS 2004b).

Min/Max Detections (Current situation)

Current groundwater data were evaluated in the RI Report's Baseline Human Health Risk Assessment (Appendix D). This data set includes four quarters of groundwater data in 1999 and one round in February 2001. The maximum constituent concentrations are summarized in Supplemental Table 2 from SECOR (2002). In addition to the supplemental summary table, the recent minimum and maximum TPH concentrations in the groundwater plume at the site are listed below.

Analyte	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)
Total Petroleum Hydrocarbons (TPH)		
TPH-G	475	6,150
TPH-D	<250	21,800
TPH-Dx (Heavy Oil Range)	<500	1,430

µg/L = micrograms per liter

Preferential Pathways

The natural buried erosional channel oriented west to east that contains coarse gravel material is considered a preferential pathway for groundwater flow at the site and tends to concentrate the LNAPL and the dissolved plume at the site. This unit is much more permeable than the surrounding finer-grained alluvial deposits. However, the effect of the seawall at the erosional channel/river interface is unclear at this time.

No information has been presented regarding the depths of the utilities at the facility relative to the groundwater table or if they may be considered a preferential pathway at the site.

Downgradient Plume Monitoring Points (min/max detections)

Two sets of downgradient groundwater data are available from the SMC investigation (URS 2004b). Groundwater samples were collected from both the new wells generally at the top of the riverbank and the five probes drilled through the seawall (revetment samples). The following table summarizes the minimum and maximum concentrations from the wells and borings at the top of the bank line.

Analyte	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)
Total Petroleum Hydrocarbons (TPH)		
TPH-G	123	2,710
TPH-D	<238	295,000
TPH-Dx (Heavy Oil Range)	<952	11,800
Polycyclic Aromatic Hydrocarbons (PAHs)		
Acenaphthene	0.100 U	5.78
Acenaphthylene	0.100 U	0.100 U
Anthracene	0.100 U	4.39
Benzo(a)anthracene	0.100 U	2.22
Benzo(a)pyrene	0.100 U	1.05
Benzo(b)fluoranthene	0.100 U	0.917
Benzo(g,h,i)perylene	0.100 U	0.81
Benzo(k)fluoranthene	0.100 U	0.738
Chrysene	0.100 U	1.12
Dibenzo(a,h)anthracene	0.100 U	0.100 U
Fluoranthene	0.100 U	4.84
Fluorene	0.100 U	0.667
Indeno(1,2,3-cd)pyrene	0.100 U	0.100 U
Naphthalene	0.100 U	0.100 U
Phenanthrene	0.100 U	48.1
Pyrene	0.100 U	5.14
Volatile Organic Compounds (VOCs)		
Benzene	<0.5	40.2
Toluene	<0.5	2.57
Ethylbenzene	<0.5	1.7
Total Xylenes	<0.5	1.2
Naphthalene	<1	460
1,2,4-TMB	<1	<1
1,3,5-TMB	<1	<1
n-Propylbenzene	<2	116
n-Butylbenzene	<2	20
MTBE	<1	148

mg/L = milligrams per liter (ppm)
µg/L = micrograms per liter (ppb)
U = undetected at the detection limit shown

Visual Seep Sample Data

☐ Yes ☒ No

Seep sample data are not available.

Nearshore Porewater Data

No nearshore porewater data were available in the site's investigation reports.

Groundwater Plume Temporal Trend

Because most of the historical effort has been focused on the LNAPL at the site, temporal trend data relative to the dissolved plume are not sufficient to draw conclusions. The

LNAPL plume has existed at the site since the early 1970s and is still present. Additional dissolved plume data collection is planned as part of the SCM to be implemented in the fall of 2004.

10.2.4. Summary

A petroleum hydrocarbon LNAPL plume and dissolved groundwater plume are present beneath the site (see Figure 3). The shallow groundwater discharges to the river. The LNAPL plume is located in the central portion of the site within the more permeable filled channel zone. The dissolved plume extends laterally to both the northern and southern site boundaries and discharges. A containment system has been in place since 1971 that has been effective at controlling LNAPL discharge to the river. An updated/new containment system is scheduled for installation in the fall of 2004 to contain both free product and prevent dissolved-phase hydrocarbons from discharging to the river. Based on the geometry of the buried channel, it is likely that the buried channel is a natural preferential groundwater discharge pathway for groundwater transport of contaminants at the site toward the river.

10.3. Surface Water

An illustration of the stormwater drainage system is shown in Supplemental Figure, Portland Environmental Compliance Tank Farm – General Site Map. Most of the site is impermeable to stormwater infiltration, with the exception of the north and south tank farms, which are covered with gravel fill. Stormwater within the tank farm areas infiltrates into the ground. Supplemental Figure, Portland Environmental Compliance Tank Farm – General Site Map shows stormwater piping under both the north and south tank farms, but according to SECOR (2000) storm drains in this area are locked closed.

Stormwater from paved surfaces is currently collected and transported to a carbon treatment system or to an oil/water separator and discharged either to the sanitary system or to the Willamette River under NPDES general permits. There are nine outfalls at or adjacent to the site (listed from upstream to downstream):

WR-202 (active)

WR-358 (abandoned)

WR-27 (active)

WR-357 (abandoned)

WR-356 (abandoned)

WR-355 (abandoned)

WR-25 (active)

WR-26 (active)

WR-203 (active)

There are five active outfalls associated with the site, as listed above. ARCO has permits to discharge from outfalls WR-25 and WR-26. Two non-City outfalls, WR-202 and WR-203, are located at the upstream and downstream property lines and receive flow from Forest Park and Highway 30. Information about potential sources to these outfalls was not found during research for this site. Similarly, no information on Outfall WR-27 was located.

Stormwater originating from the paved oil lubricating tank farm is directed to the north oil/water separator, and stormwater from the catch basins near the truck and rail-spur loading

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racks is routed to Tank 19, where the stormwater is temporarily stored prior to passing through a carbon treatment system and being discharged to the sanitary system. On an as-needed basis, water collected in Tank 19 is pumped through the carbon treatment system used for the riverfront groundwater interceptor system and then discharged to the south oil/water separator before being discharged to the sanitary sewer. Water pumped from the groundwater inceptor system is temporarily diverted to Tank 2 while water from Tank 19 is being treated, and then subsequently pumped back to the carbon treatment system. The carbon treatment system discharges the treated water from the interceptor wells to the Willamette under an NPDES 15A permit (SECOR 2002).

10.3.1. Surface Water Investigation ☐ Yes ☒ No

10.3.2. General or Individual Stormwater Permit (Current or Past) ☐ Yes ☒ No

Treated stormwater is discharged from Outfalls WR-26 and WR-25 and monitored under ARCO's NPDES 13J and 15A permits, respectively (see Section 10.3.5).

Do other non-stormwater wastes discharge to the system? ☐ Yes ☒ No

10.3.3. Stormwater Data ☐ Yes ☒ No

10.3.4. Catch Basin Solids Data ☐ Yes ☒ No

10.3.5. Wastewater Permit ☒ Yes ☐ No

Process water is collected from draining storage tank water, truck-loading rack, rail car offloading area, and marine dock operations. The process water is routed through an oil/water separator and two 10,000-lb carbon adsorption beds and discharged to the City of Portland sanitary sewer under a wastewater discharge permit (SECOR 2000).

Permit Type	Permit No.	Start Date	Outfalls	Volumes	Parameters/Frequency
GEN 15A	10035	5/17/95	WR-25	?	Standard/twice yearly[1]
GEN13J	10036	4/4/84	WR-26	?	Standard/weekly to quarterly[2]
GEN 12T	10037 (expired)	12/12/01	?	?	?

[1] Standard GEN 15A permit requirements include TPH, BTEX, lead, pH, flow, and visual monitoring.
[2] Standard GEN 13 permit requirements include flow and oil and grease. Total suspended solids, pH, copper, lead, zinc, ethanol and methyl-t-butyl ether (MTBE) may also be required.

10.3.6. Wastewater Data ☐ Yes ☒ No

10.3.7. Summary

Stormwater is treated by activated carbon treatment system and oil/water separator constructed in the late 1960s for groundwater treatment prior to discharge to the river.

Fuel transfer activities at the dock may directly contribute contaminants to in-water media (SECOR 2002; GSI 2003). There have been several documented overwater spills at this facility (see Section 8.3 above). Since 2003, there have been seven small quantity "incidents" of oil sheens observed within the permanent boom area on the Willamette River.

10.4. *Sediment*

10.4.1. River Sediment Data

☒ Yes ☐ No

Three sediment investigations have occurred offshore of ARCO since 1997 (see Figure 1). Weston (1998) collected sediment from four sampling locations: SD041, upstream from the ARCO dock; and SD039, SD038, and SD037, all downstream from the dock and along the ARCO terminal property. Battelle (2002) collected a single surface (1-10 cm) sample (LPSG-5-028-R-l) in 1997, as part of the Light Products Study Group investigation. During the RI, SECOR (2002) collected surface sediment data in the vicinity of ARCO. Sediment data from these investigations are summarized in Table 2.

The RI (SECOR 2002) concluded that based on the majority of sediment samples collected adjacent to ARCO, PAH impacts appear to be from sources other than petroleum releases. Although DEQ concurs with this conclusion, the agency believes that the sediment investigation is incomplete and that additional sediment characterization, such as vertical and lateral nature and extent, and an understanding of depositional history are necessary (DEQ 2002). DEQ (2003a) has recommended further subsurface sediment sampling offshore of the lube oil tank farm [see Supplemental Figure 9 from SECOR (2002)].

10.4.2. Summary

See Final CSM Update.

11. CLEANUP HISTORY AND SOURCE CONTROL MEASURES

11.1. *Soil Cleanup/Source Control*

The following soil cleanup/source control measures have occurred at the ARCO site since the 1940s:

- Construction of concrete seawall adjacent to river waterfront between 1942 and 1945.
- Construction of stormwater collection system and two oil-water separators in 1968.
- Installation of additional storm drainage systems in 1971.
- Removal of 1,800 tons of petroleum-contaminated soil in 1993, including the areas around a 1991 diesel pipeline release (LUST# 26-91-0254), the March 1992 construction of railroad spur, the June 1992 trenching for a new pipeline, and the December 1992 removal of a waste oil tank (LUST# 26-92-0364).
- Implementation of source control measures, including new pumps, replacement of meters and sensors, upgrading of piping, and installation of new electrical service and a 5-inch-diameter containment boom for controlling sheens on the river from February to June 2003 (URS 2002).

11.2. *Groundwater Cleanup/Source Control*

<u>Existing Product and Dissolved Plume Containment System.</u>

- Installation of the seawall, which assists in containing the LNAPL at the site [see Supplemental Figures 5 and 6 from URS (2004b)].
- Installation of four interceptor wells adjacent to the seawall for source control by 1971.
- Installation of two additional interceptor wells for source control in 1994.
- Installation of two additional recovery wells (RW-1 and RW-2) in 1997.

This system has been relatively successful at containing LNAPL; however, the system's effectiveness at containing the dissolved plume at the site is unclear. DEQ has required SCM to be implemented at the site.

DEQ Upland SCM.

- Implementation of SCM to enhance the existing containment and extraction systems for liquid-phase petroleum and dissolved contaminants is projected for construction in the fall of 2004 [see Supplemental Figure 8 from URS (2004b)].

11.3. Other

11.4. Potential for Recontamination from Upland Sources

See Final CSM Update.

12. BIBLIOGRAPHY / INFORMATION SOURCES

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Figures:

Tables:

Supplemental Scanned Figures:

Figure 6. Existing Seawall Geometry (URS 2004b)
Figure 7. Estimated Extent of Dissolved Phase Impacts (URS 2004b)
Figure 8. SCM System Layout (URS 2004b)
Figure 9. Product Thickness (Feet) Based on Groundwater Sampling Event on February 20, 2001 (SECOR 2002)
Figure 9. Product Thickness (Feet) Based on Groundwater Sampling Event on February 20, 2001 (with DEQ notes) (SECOR 2002)
Figure 13. Isocontour Map of TPH-D Concentrations in Soils from Depths Greater than 16 Feet (SECOR 2002)
Figure 17. Isocontour Map of Benzene Concentrations in Soils from 8-16 Feet (SECOR 2002)
Figure 20. Isocontour Map of Benzo(a)pyrene Concentrations in Soils from 8-16 Feet (SECOR 2002)
Figure 35. Isocontour Map of TPH-G and TPH-D Concentrations in Groundwater (SECOR 2002)
Figure 2-2. Site Plan-View Map (URS 2004b)
Figure 4-1. Hydrogeologic Cross Section A-A' (URS 2004b)
Figure 4-2. Hydrogeologic Cross Section B-B' (URS 2004b)
Figure 4-3. Hydrogeologic Cross Section C-C' (URS 2004b)
Figure 4-4. Hydrogeologic Cross Section D-D' (URS 2004b)
Figure 4-5, Hydrogeologic Cross Section E-E' (URS 2004b)
Figure 4-6. Hydrogeologic Cross Section F-F' (URS 2004b)
Figure 4-7. Hydrogeologic Cross Section G-G' (URS 2004b)
Figure 4-8. Interpreted Elevation of Base of Fill Materials
Figure 4-11. Interpreted Equivalent Groundwater Table on August 25, 2002, Low Flow Conditions (URS 2004b)
Figure 4-12. Interpreted Equivalent Groundwater Table on January 24, 2004, High Flow Conditions (URS 2004b)
Portland Environmental Compliance Tank Farm – General Site Map

Supplemental Scanned Table:

Table 5. Summary Statistics for Groundwater Contaminants of Interest (SECOR 2002)

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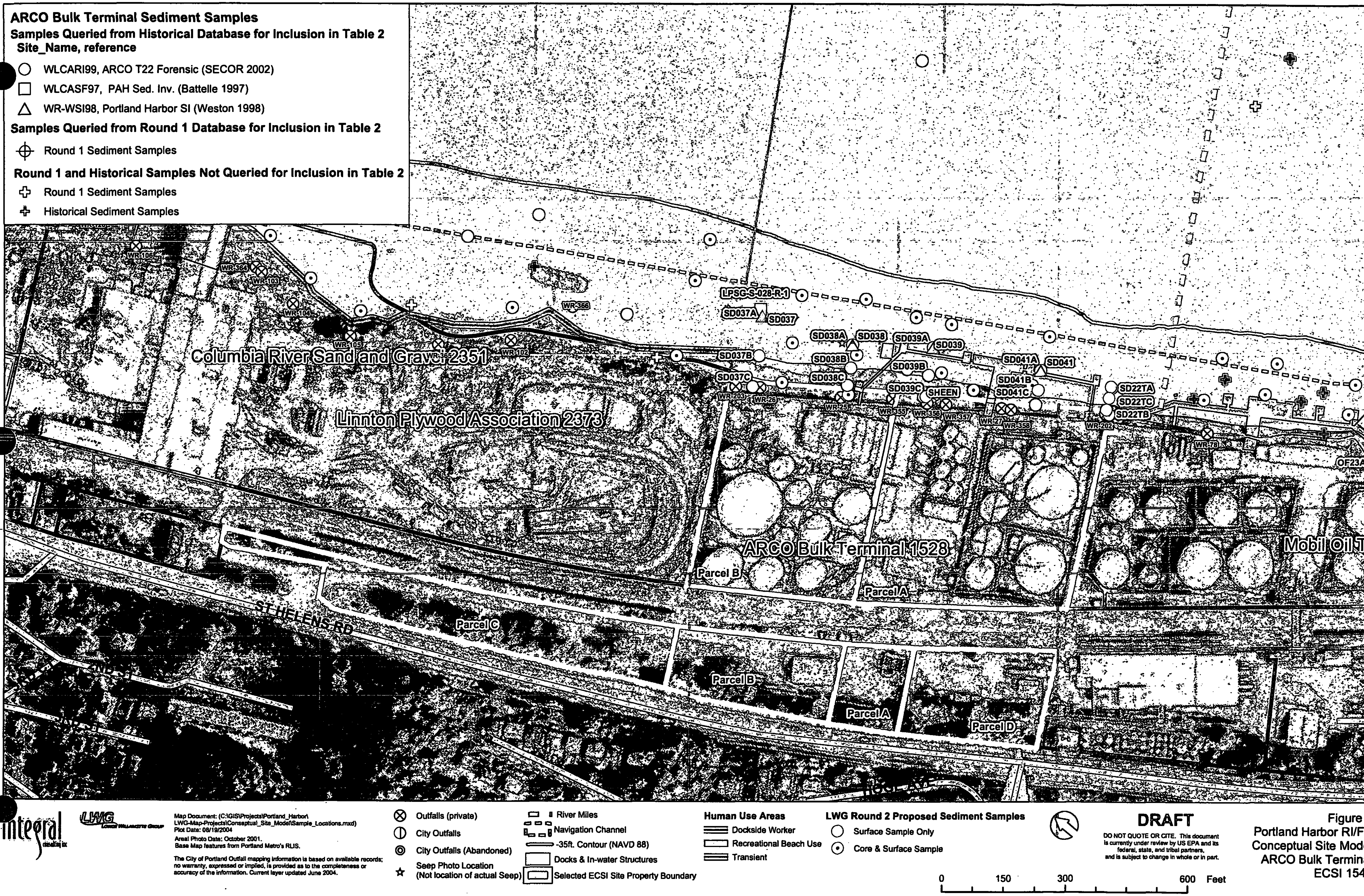
FIGURES



integral consulting inc

LWG Lower Willamette Group

Map Document: (C:\GIS\Projects\Portland_Harbor\LWG-Map-Projects\Conseptual_Site_Model\Sample_Locations.mxd)
Plot Date: 08/19/2004

Areal Photo Date: October 2001.
Base Map features from Portland Metro's RLIS.

The City of Portland Outfall mapping information is based on available records; no warranty, expressed or implied, is provided as to the completeness or accuracy of the information. Current layer updated June 2004.

DRAFT

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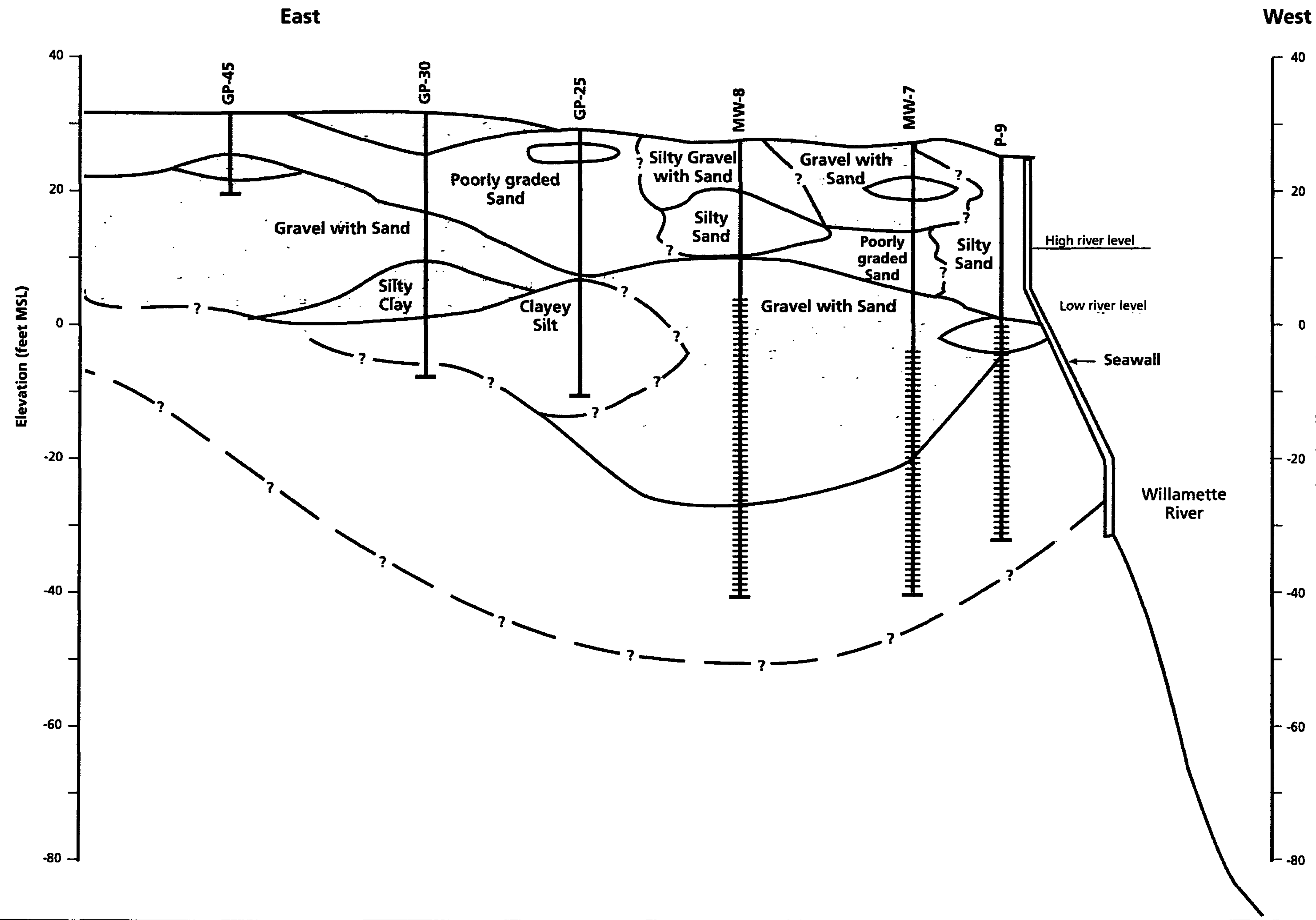
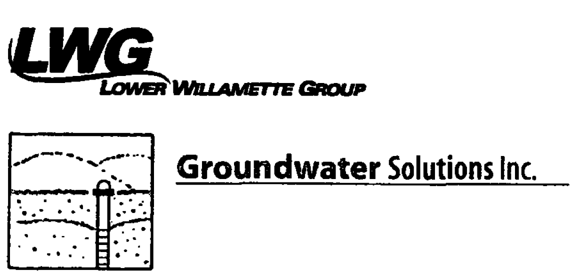
Figure 1
Portland Harbor RI/FS
Conceptual Site Model
ARCO Bulk Terminal
ECSI 1549





LEGEND

0 50 100

HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION = 10X

Scale and elevations are approximate.

References: Final Remedial Investigation Report, ARCO Terminal 22T (SECOR, 2002) Bathymetric Survey (DEA, 2002)

LW-6D

- Boring/Well ID
- Surface elevation along profile
- Groundwater level
- Boring/Well, Projected
- Bottom of boring/well

- Gravel with Sand — Pleistocene Flood Deposits (gravel)
- Silty Sand
- Poorly Graded Sand
- Silty Gravel with Sand
- Silty Clay
- Clayey Silt

Silty Sand, Poorly Graded Sand, Silty Gravel with Sand, Silty Clay and Clayey Silt — Pleistocene Flood Deposits and Recent Alluvium (undifferentiated sand and silt)

Figure 2

Portland Harbor RI/FS
Hydrogeologic Cross Section
ARCO Terminal 22T

GROUNDWATER SOLUTIONS, INC.

Groundwater Solutions Inc.

LWG
LOWER WILLAMETTE GROUP

0 100 200 Feet

FEATURE SOURCES:
Transportation, Water, Property, Zoning or Boundaries: Metro RLIS.
ECSI site locations were summarized in December, 2002
and January, 2003 from ODEQ ECSI files.

Map Creation Date: August 11, 2004

File Name: Fig3_ARCO_SummaryMap.mxd

LEGEND

Site Boundary

Maximum Detection Location

General Groundwater Flow

Contaminant Type

Petroleum related

Extent of Impacted Groundwater

For details, refer to plume interpretation table in CSM document.

Single or isolated detection of COI's. Extent or continuity of impacted groundwater between sample points is uncertain. Color based on contaminant type.

Estimated extent of impacted groundwater area. Color based on contaminant type.

Figure 3
Portland Harbor RI/FS
ARCO Terminal 22-T
Upland Groundwater Quality Overview

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TABLES

ARCO Bulk Terminal #1528
Table 1. Potential Sources and Transport Pathways Assessment

Last Updated: September 17, 2004

Potential Sources	Media Impacted					COIs																	Potential Complete Pathway				
						TPH			VOCs																		
Description of Potential Source	Surface Soil	Subsurface Soil	Groundwater	Storm Sewer Sediment	River Sediment	Gasoline-Range	Diesel - Range	Heavier - Range	Petroleum-Related (e.g. BTEX)	VOCs	Chlorinated VOCs	SVOCs	PAHs	Pathalates	Phenolics	Metals	PCBs	Herbicides and Pesticides	Dioxins/Furans	Butyltins	Others -List	Others -List	Others -List	Overland Transport	Groundwater	Direct Discharge - Overwater	Direct Discharge - Storm/Wastewater	Riverbank Erosion
Upland Areas																												
Truck-loading rack area (SECOR 2002)	✓	✓	✓			✓	✓	✓	✓	✓			✓	?		✓									✓		✓	
Remanufacturing warehouse (SECOR 2002)	✓	✓	✓			✓	✓	✓	✓	✓			✓	?		✓									✓		✓	
Tank farms (SECOR 2002)				✓	✓	✓	✓	✓	✓	✓				?		✓											✓	
Historic spill areas (SECOR 2002)	✓	?	?				✓						?			?									?		✓	
Groundwater plume (SECOR 2002)			✓		✓	✓	✓		✓				✓			✓									✓			
Seepage from interceptor well system and seawall ((SECOR 2002, DEQ 2004)					✓				✓							?									✓			
Overwater Areas																												
Dock operations					✓		✓	✓	✓				✓			✓										?		
Other Areas/Other Issues																												

Notes:

[1] All information provided in this table is referenced in the site summaries. If information is not available or inconclusive, a ? may be used, as appropriate. No new information is provided in this table.

✓ = Source, COI are present or current or historic pathway is determined to be complete or potentially complete

? = There is not enough information to determine if source or COI is present or if pathway is complete.

Blank = Source, COI and historic and current pathways have been investigated and shown to be not present or incomplete.

UST	Underground storage tank
AST	Above-ground storage tank
TPH	Total petroleum hydrocarbons
VOCs	Volatile organic compounds
SVOCs	Semivolatile organic compounds
PAHs	Polycyclic aromatic hydrocarbons
BTEX	Benzene, toluene, ethylbenzene, and xylenes
PCBs	Polychorinated biphenols

Table 2. Queried Sediment Chemistry Data

				Detected Concentrations					Detected and Nondetected Concentrations				
Analyte	N	N Detected	% Detected	Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
Total solids (percent)	16	16	100	43.4	94.3	63	58.1	93.9	43.4	94.3	63	58.1	93.9
Total organic carbon (percent)	21	21	100	0.15	3.43	1.52	1.59	2.24	0.15	3.43	1.52	1.59	2.24
Gravel (percent)	19	19	100		60.3	11	0.43	43	0	60.3	11	0.43	43
Sand (percent)	4	4	100	22.49	27.92	25.3	23.33	27.29	22.49	27.92	25.3	23.33	27.29
Very coarse sand (percent)	16	16	100	0.1	28.8	5.29	0.84	12.9	0.1	28.8	5.29	0.84	12.9
Coarse sand (percent)	16	16	100	0.18	33.5	8.72	1.82	31	0.18	33.5	8.72	1.82	31
Medium sand (percent)	16	16	100	0.08	55.5	10.8	5.1	32.7	0.08	55.5	10.8	5.1	32.7
Fine sand (percent)	16	16	100	1.71	30.8	10.2	8.3	22.3	1.71	30.8	10.2	8.3	22.3
Very fine sand (percent)	16	16	100	0.02	18.9	6.96	4.1	18.7	0.02	18.9	6.96	4.1	18.7
Fines (percent)	4	4	100	72.05	77.24	74.6	72.4	76.67	72.05	77.24	74.6	72.4	76.67
Silt (percent)	19	19	100	0.12	79	41.9	56.8	70.8	0.12	79	41.9	56.8	70.8
Coarse silt (percent)	1	1	100	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9
Medium silt (percent)	1	1	100	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1
Fine silt (percent)	1	1	100	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
Very fine silt (percent)	1	1	100	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
Clay (percent)	19	19	100	0.03	14.67	5.97	6.23	13.31	0.03	14.67	5.97	6.23	13.31
8-9 Phi clay (percent)	1	1	100	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
9-10 Phi clay (percent)	1	1	100	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
>10 Phi clay (percent)	1	1	100	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Aluminum (mg/kg)	4	4	100	38000	40400	39600	39700	40200	38000	40400	39600	39700	40200
Antimony (mg/kg)	20	0	0						5 UJ	10 U	9	10 U	10 U
Arsenic (mg/kg)	20	17	85	2	7	4.24	4	7	2	7	4.35	4	7
Cadmium (mg/kg)	20	4	20	0.3	0.4	0.325	0.3	0.3	0.3	1 U	0.865	1 U	1 U
Chromium (mg/kg)	20	20	100	8	62	29	28	41	8	62	29	28	41
Copper (mg/kg)	20	20	100	23	131	49.6	41.1	95	23	131	49.6	41.1	95
Lead (mg/kg)	20	20	100	9	73	20.9	17	35	9	73	20.9	17	35
Manganese (mg/kg)	4	4	100	677	854	777	773	804	677	854	777	773	804
Mercury (mg/kg)	20	5	25	0.06	0.5	0.154	0.07	0.07	0.06	0.5	0.189	0.2 U	0.2 U
Nickel (mg/kg)	20	20	100	12	31	24.2	24	31	12	31	24.2	24	31
Selenium (mg/kg)	20	4	20	10	12	11.5	12	12	1 U	12	3.1	1 U	12
Silver (mg/kg)	20	4	20	0.8	0.9	0.875	0.9	0.9	0.8	2 U	1.78	2 U	2 U
Thallium (mg/kg)	20	4	20	21	23	21.8	21	22	1 U	23	5.15	1 U	22
Zinc (mg/kg)	20	20	100	81	483	123	99.8	170	81	483	123	99.8	170
Barium (mg/kg)	4	4	100	184	192	187	186	186	184	192	187	186	186
Beryllium (mg/kg)	20	5	25	0.66	1	0.752	0.7	0.7	0.66	1 U	0.938	1 U	1 U
Calcium (mg/kg)	4	4	100	7740 J	8470 J	8080	7930 J	8160 J	7740 J	8470 J	8080	7930 J	8160 J
Cobalt (mg/kg)	4	4	100	18.7	19.9	19.4	19.3	19.5	18.7	19.9	19.4	19.3	19.5
Iron (mg/kg)	4	4	100	42400	44200	43300	43100	43400	42400	44200	43300	43100	43400
Magnesium (mg/kg)	4	4	100	6670	7040	6840	6740	6920	6670	7040	6840	6740	6920
Potassium (mg/kg)	4	4	100	1280	1440	1380	1360	1420	1280	1440	1380	1360	1420
Sodium (mg/kg)	4	4	100	978	1170	1060	1030	1070	978	1170	1060	1030	1070
Vanadium (mg/kg)	4	4	100	104	110	107	106	108	104	110	107	106	108
2-Methylnaphthalene (ug/kg)	20	12	60	6	410	61	24	63	5 U	410	40	19 U	63
Acenaphthene (ug/kg)	21	19	90.5	6	5000	343	30	530	5 U	5000	311	29	250
Acenaphthylene (ug/kg)	21	16	76.2	11	150	52	34	140	5 U	150	42.1	22	110
Anthracene (ug/kg)	21	20	95.2	5	2700	239	70	390	5	2700	228	70	290
Fluorene (ug/kg)	21	19	90.5	8	2100	188	26	590	5 U	2100	170	24	230
Naphthalene (ug/kg)	21	18	85.7	6	1000	101	45	130	5 U	1000	87.6	42	110
Phenanthrene (ug/kg)	21	21	100	7	16000	1150	280	1200	7	16000	1150	280	1200
Low Molecular Weight PAH (ug/kg)	21	21	100	7 A	26950 A	1990	496 A	1983 A	7 A	26950 A	1990	496 A	1983 A
Dibenz(a,h)anthracene (ug/kg)	21	21	100	6	560	90.9	46	250	6	560	90.9	46	250
Benz(a)anthracene (ug/kg)	21	21	100	13	2600	638	340	2200	13	2600	638	340	2200
Benzo(a)pyrene (ug/kg)	21	21	100	18	3700	821	480	2700	18	3700	821	480	2700

DO NOT QUOTE OR CITE.
This document is currently under review by US EPA.

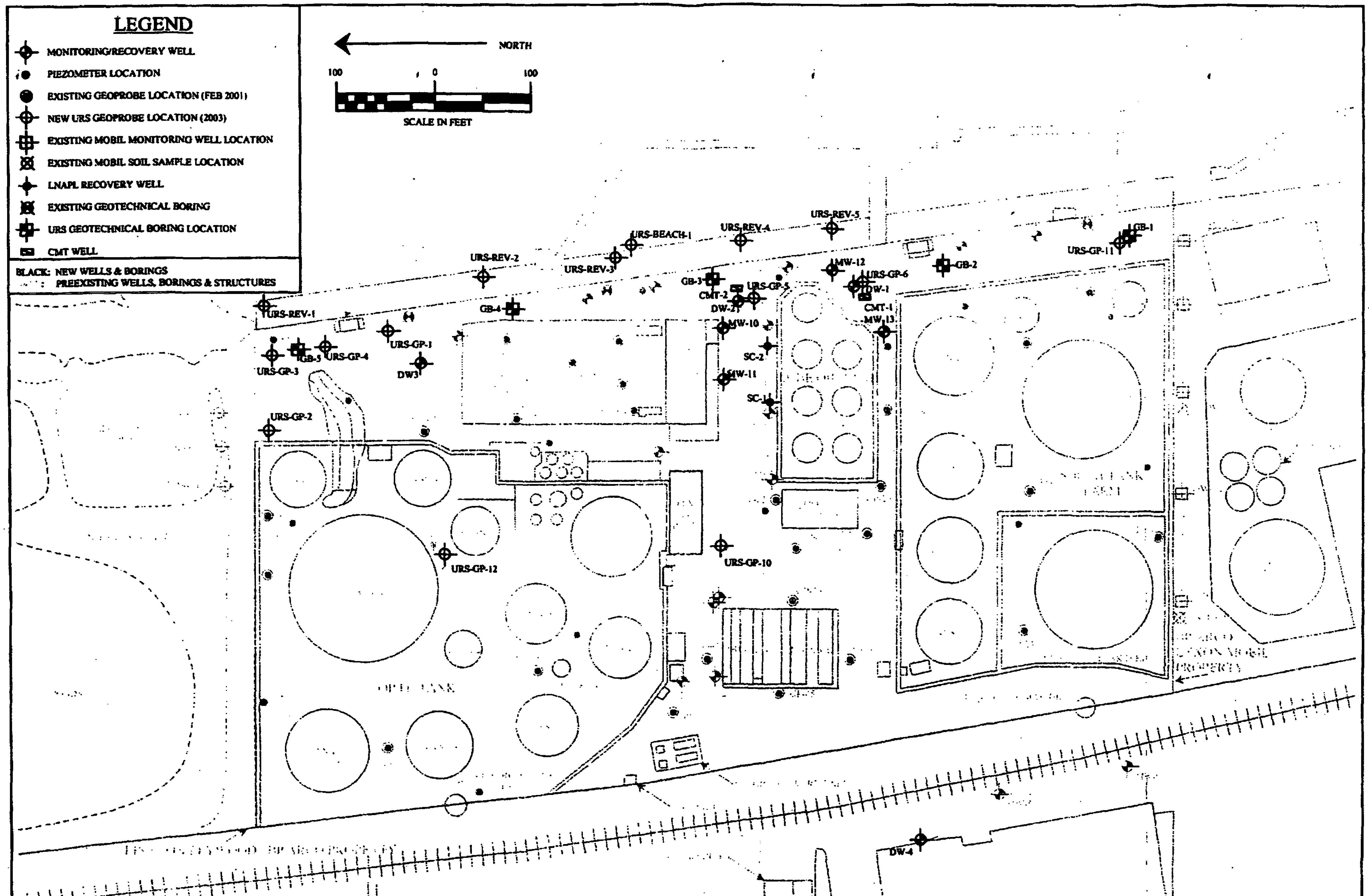
Table 2. Queried Sediment Chemistry Data

Analyte	N	N Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
Benzo(b)fluoranthene (ug/kg)	21	20	95.2	18	1800	504	190	1800	5 U	1800	480	190	1700
Benzo(g,h,i)perylene (ug/kg)	21	21	100	32	3100	528	270	1300	32	3100	528	270	1300
Benzo(k)fluoranthene (ug/kg)	20	20	100	17	2300	465	250	1400	17	2300	465	250	1400
Chrysene (ug/kg)	21	21	100	21	3500	757	450	2800	21	3500	757	450	2800
Fluoranthene (ug/kg)	21	21	100	16	10000	1680	910	5200	16	10000	1680	910	5200
Indeno(1,2,3-cd)pyrene (ug/kg)	21	21	100	31	2500	627	280	1800	31	2500	627	280	1800
Pyrene (ug/kg)	21	21	100	14	12000	1870	660	6200	14	12000	1870	660	6200
Benzo(b+k)fluoranthene (ug/kg)	4	4	100	210 A	4100 A	1310	230 A	680 A	210 A	4100 A	1310	230 A	680 A
Benzo(j+k)fluoranthene (ug/kg)	1	1	100	100	100	100	100	100	100	100	100	100	100
High Molecular Weight PAH (ug/kg)	21	21	100	186 A	41860 A	7940	4607 A	27060 A	186 A	41860 A	7940	4607 A	27060 A
Polycyclic Aromatic Hydrocarbons (ug/kg)	21	21	100	193 A	68810 A	9930	5108 A	28608 A	193 A	68810 A	9930	5108 A	28608 A
Benzo(e)pyrene (ug/kg)	1	1	100	95	95	95	95	95	95	95	95	95	95
1-Methylnaphthalene (ug/kg)	16	8	50	1	68	28	16	47	1	68	16.5	5 U	47
C1-Dibenzothiophene (ug/kg)	17	7	41.2	7	7400	1120	20	270	5 U	7400	464	5 U	270
C1-Chrysene (ug/kg)	17	15	88.2	25	1900	330	200	660	5 U	1900	292	180	660
C1-Fluorene (ug/kg)	17	15	88.2	7	1300	131	23	290	5 U	1300	116	17	290
C1-Naphthalene (ug/kg)	1	1	100	13	13	13	13	13	13	13	13	13	13
C1-Fluoranthene/pyrene (ug/kg)	17	16	94.1	30	3300	425	200	750	5 U	3300	400	200	750
C1-Phenanthrene/anthracene (ug/kg)	17	16	94.1	14	1700	258	130	440	5 U	1700	243	130	440
C2-Dibenzothiophene (ug/kg)	17	14	82.4	9	1600	157	31	190	5 U	1600	130	23	190
C2-Chrysene (ug/kg)	17	9	52.9	14	1600	263	110	200	5 U	1600	142	14	200
C2-Fluorene (ug/kg)	17	12	70.6	8	4400	427	30	350	5 U	4400	303	14	350
C2-Naphthalene (ug/kg)	17	15	88.2	8	840	125	37	520	5 U	840	111	26	520
C2-Fluoranthene/pyrene (ug/kg)	1	1	100	47	47	47	47	47	47	47	47	47	47
C2-Phenanthrene/anthracene (ug/kg)	17	16	94.1	11	6000	490	96	430	5 U	6000	462	96	430
C3-Dibenzothiophene (ug/kg)	17	12	70.6	7	1100	129	30	130	5 U	1100	92.8	20	130
C3-Chrysene (ug/kg)	17	6	35.3	20	830	190	52	120	5 U	830	70.2	5 U	120
C3-Fluorene (ug/kg)	17	1	5.88	20	20	20	20	20	5 U	20	5.88	5 U	5 U
C3-Naphthalene (ug/kg)	17	15	88.2	9	9000	730	36	1100	5 U	9000	645	34	1100
C3-Fluoranthene/pyrene (ug/kg)	1	1	100	29	29	29	29	29	29	29	29	29	29
C3-Phenanthrene/anthracene (ug/kg)	17	15	88.2	17	4200	358	59	400	5 U	4200	317	56	400
C4-Dibenzothiophene (ug/kg)	1	1	100	15	15	15	15	15	15	15	15	15	15
C4-Chrysene (ug/kg)	17	2	11.8	7	810	409	7	7	5 U	810	52.5	5 U	7
C4-Naphthalene (ug/kg)	17	15	88.2	10	18000	1290	35	740	5 U	18000	1140	27	740
C4-Phenanthrene/anthracene (ug/kg)	17	5	29.4	19	1500	327	36	56	5 U	1500	99.7	5 U	56
Total benzofluoranthenes (b+k (+j)) (ug/kg)	1	1	100	202	202	202	202	202	202	202	202	202	202
Diphenyl (ug/kg)	1	1	100	6	6	6	6	6	6	6	6	6	6
2,4,5-Trichlorophenol (ug/kg)	4	0	0						97 U	98 U	97.5	97 U	98 U
2,4,6-Trichlorophenol (ug/kg)	4	0	0						97 U	98 U	97.5	97 U	98 U
2,4-Dichlorophenol (ug/kg)	4	0	0						58 U	59 U	58.5	58 U	59 U
2,4-Dimethylphenol (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
2-Chlorophenol (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
2-Methylphenol (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
2-Nitrophenol (ug/kg)	4	0	0						97 U	98 U	97.5	97 U	98 U
4,6-Dinitro-2-methylphenol (ug/kg)	4	0	0						190 UJ	200 UJ	195	190 UJ	200 UJ
4-Chloro-3-methylphenol (ug/kg)	4	0	0						39 U	39 U	39	39 U	39 U
4-Methylphenol (ug/kg)	4	4	100	380	620	510	480	560	380	620	510	480	560
4-Nitrophenol (ug/kg)	4	0	0						97 U	98 U	97.5	97 U	98 U
Pentachlorophenol (ug/kg)	4	0	0						97 UJ	98 UJ	97.5	97 UJ	98 UJ
Phenol (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
Dimethyl phthalate (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
Diethyl phthalate (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
Dibutyl phthalate (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U

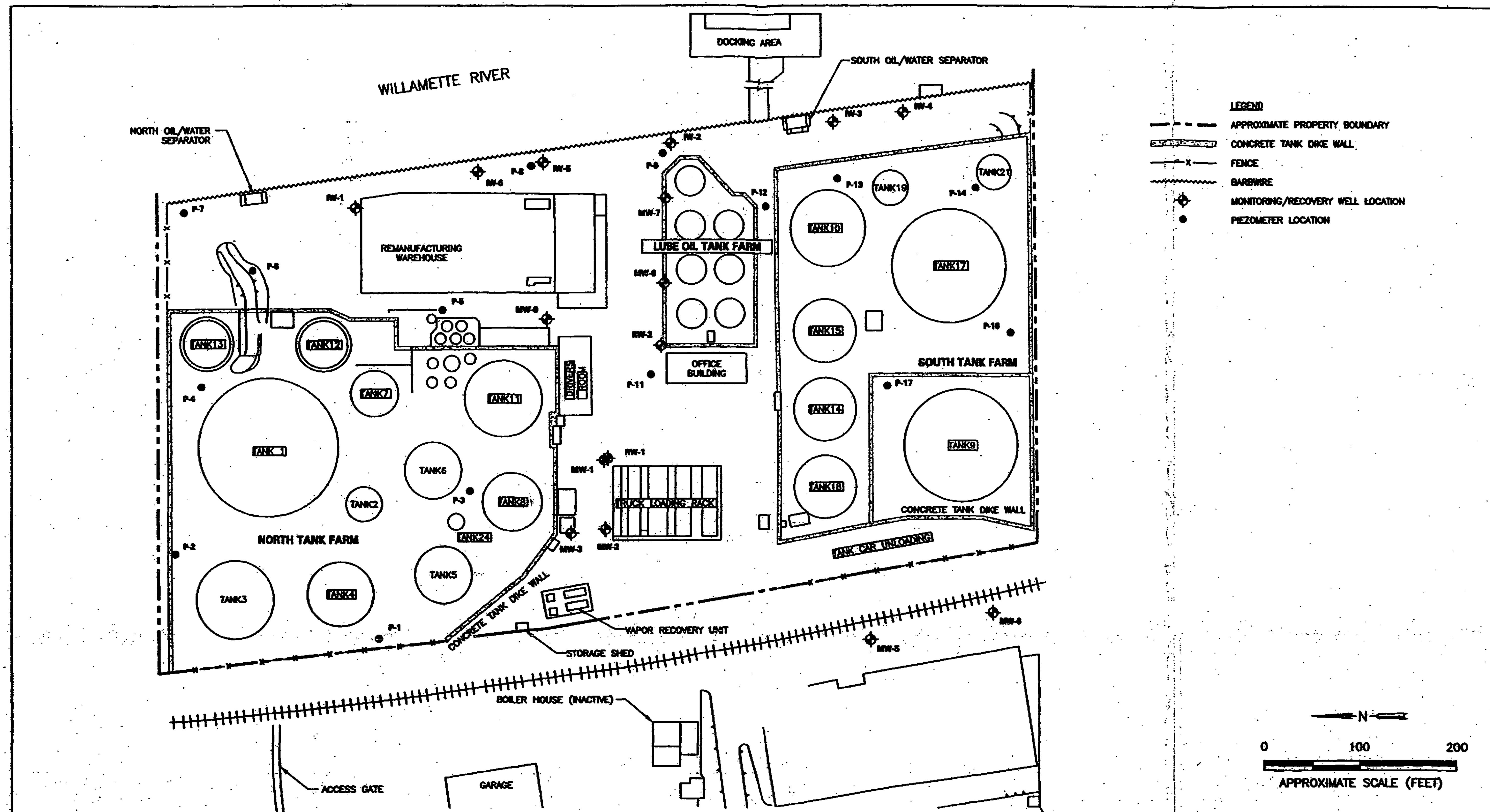
Table 2. Queried Sediment Chemistry Data

				Detected Concentrations					Detected and Nondetected Concentrations				
Analyte	N	N Detected	% Detected	Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
Butylbenzyl phthalate (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
Di-n-octyl phthalate (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
Bis(2-ethylhexyl) phthalate (ug/kg)	4	0	0						110 U	160 U	138	140 U	140 U
Bis(2-chloro-1-methylethyl) ether (ug/kg)	4	0	0						19 UJ	20 UJ	19.5	19 UJ	20 UJ
2,4-Dinitrotoluene (ug/kg)	4	0	0						97 U	98 U	97.5	97 U	98 U
2,6-Dinitrotoluene (ug/kg)	4	0	0						97 U	98 U	97.5	97 U	98 U
2-Chloronaphthalene (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
2-Nitroaniline (ug/kg)	4	0	0						97 U	98 U	97.5	97 U	98 U
3,3'-Dichlorobenzidine (ug/kg)	4	0	0						97 U	98 U	97.5	97 U	98 U
3-Nitroaniline (ug/kg)	4	0	0						120 UJ	120 UJ	120	120 UJ	120 UJ
4-Bromophenyl phenyl ether (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
4-Chloroaniline (ug/kg)	4	0	0						58 UJ	59 UJ	58.5	58 UJ	59 UJ
4-Chlorophenyl phenyl ether (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
4-Nitroaniline (ug/kg)	4	0	0						97 UJ	98 UJ	97.5	97 UJ	98 UJ
Benzoic acid (ug/kg)	4	0	0						190 U	200 U	195	190 U	200 U
Benzyl alcohol (ug/kg)	4	0	0						19 UJ	20 UJ	19.5	19 UJ	20 UJ
Bis(2-chloroethoxy) methane (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
Bis(2-chloroethyl) ether (ug/kg)	4	0	0						39 UJ	39 UJ	39	39 UJ	39 UJ
Carbazole (ug/kg)	4	4	100	34 J	200 J	83.3	39 J	60 J	34 J	200 J	83.3	39 J	60 J
Dibenzofuran (ug/kg)	21	12	57.1	8	240	49.3	10	130	5 U	240	31.7	10	97
Hexachlorobenzene (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
Hexachlorobutadiene (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
Hexachlorocyclopentadiene (ug/kg)	4	0	0						97 UJ	98 UJ	97.5	97 UJ	98 UJ
Hexachloroethane (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
Isophorone (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
Nitrobenzene (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
N-Nitrosodipropylamine (ug/kg)	4	0	0						39 U	39 U	39	39 U	39 U
N-Nitrosodiphenylamine (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
Dibenzothiophene (ug/kg)	17	14	82.4	8	150	48.1	27	97	5 U	150	40.5	22	97
Perylene (ug/kg)	1	1	100	112	112	112	112	112	112	112	112	112	112
Benzene (ug/kg)	16	0	0						50 U	100 U	62.5	50 U	100 U
Ethylbenzene (ug/kg)	16	0	0						100 U	200 U	125	100 U	200 U
Toluene (ug/kg)	16	0	0						100 U	200 U	125	100 U	200 U
Xylene (ug/kg)	16	0	0						100 U	200 U	125	100 U	200 U
1,2-Dichlorobenzene (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
1,3-Dichlorobenzene (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
1,4-Dichlorobenzene (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U
1,2,4-Trichlorobenzene (ug/kg)	4	0	0						19 U	20 U	19.5	19 U	20 U

SUPPLEMENTAL FIGURES



URS	Job No. 38476051.00546 BP Arco Terminal 22T Portland, Oregon	LOCATIONS OF MONITORING WELLS & BORINGS INSTALLED 2002 TO PRESENT	FIGURE 2



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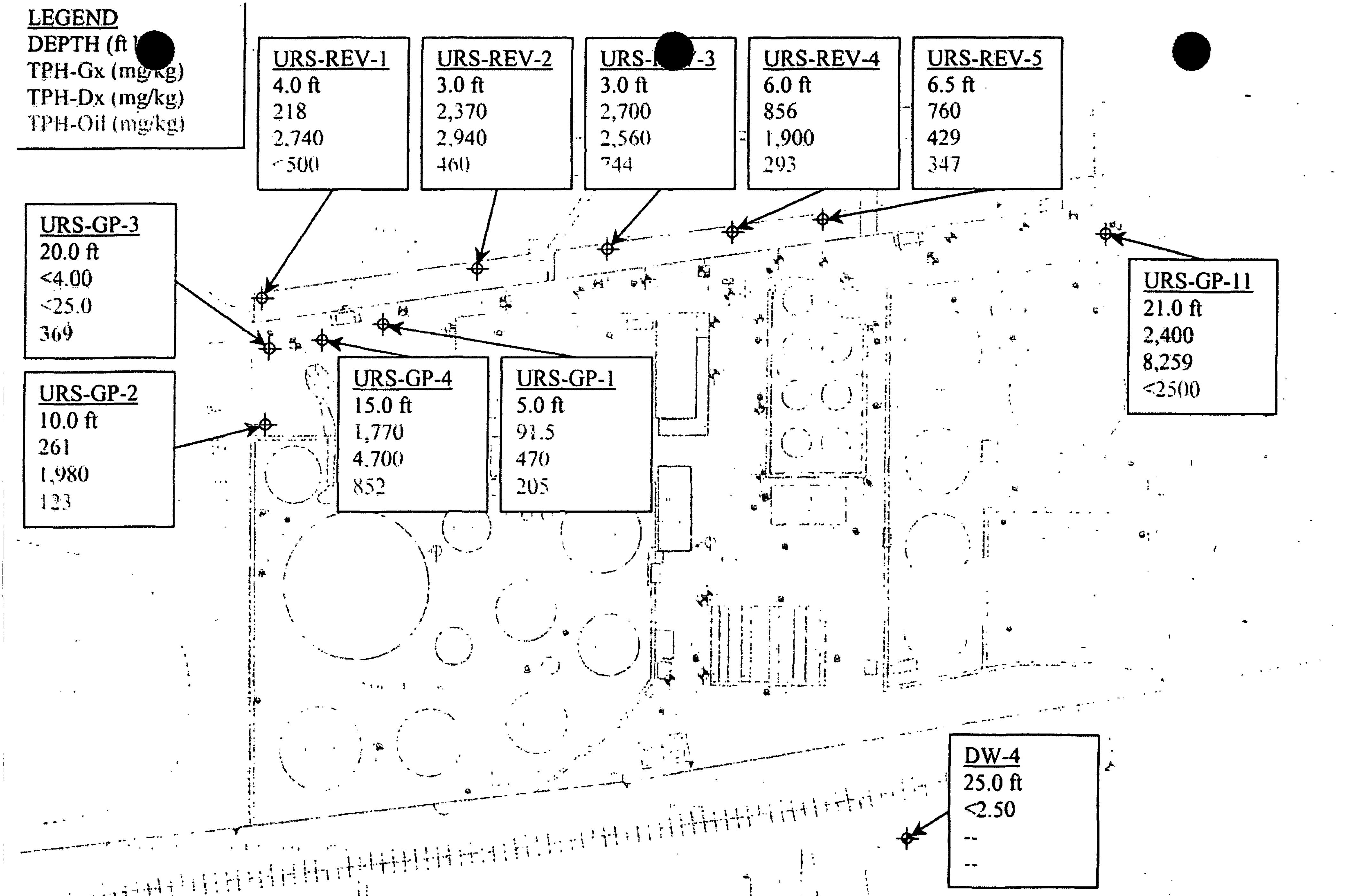
SITE PLAN

BP BULK TERMINAL 22T
9930 NW ST. HELENS ROAD
PORTLAND, OREGON

FIGURE: 3

JOB#: 15BP.0022T.01.0248 APPR: DWN: DATE: 09/13/02



NORTH

100 0 100

SCALE IN FEET

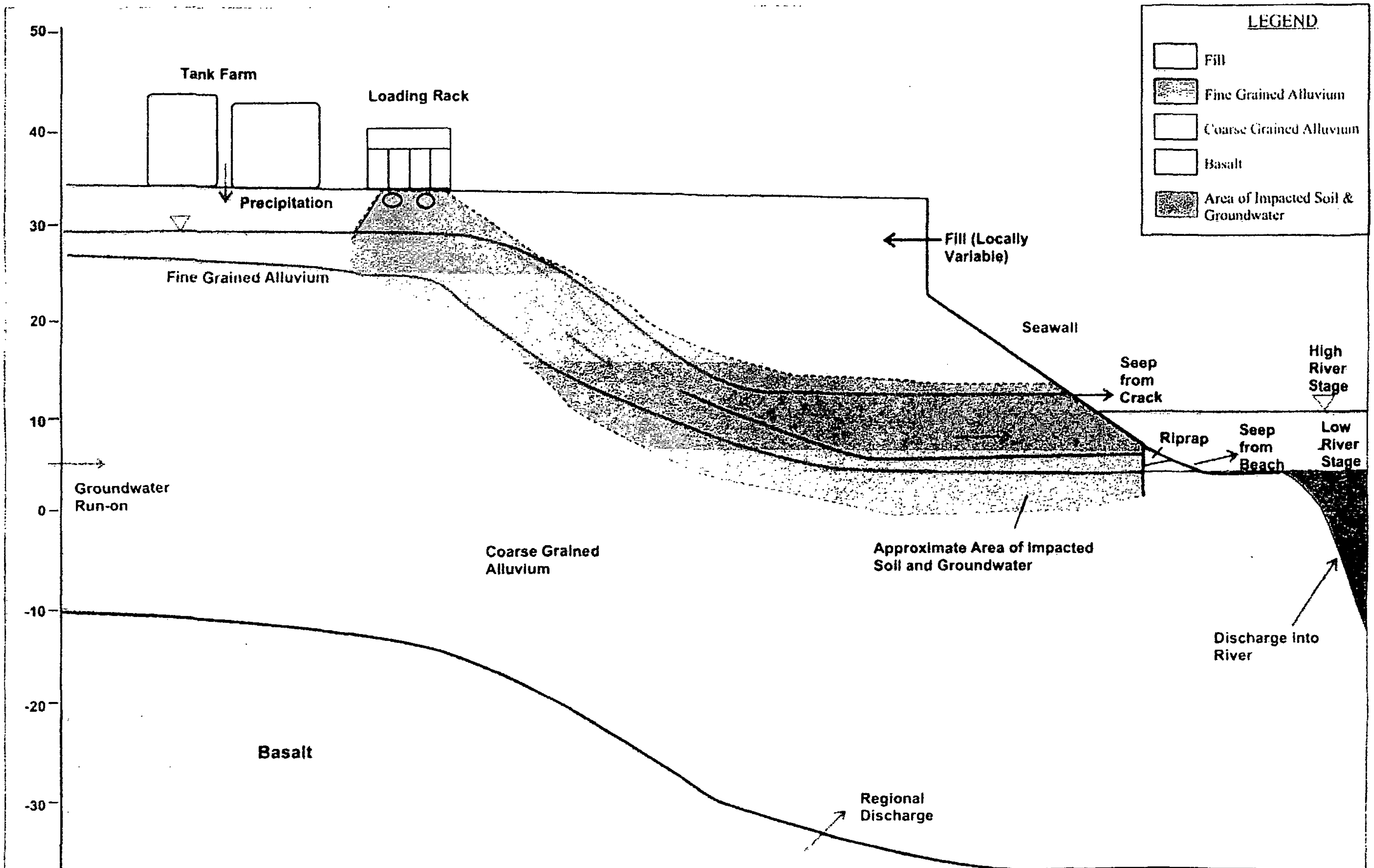
URS

Job No. 38476051.00546

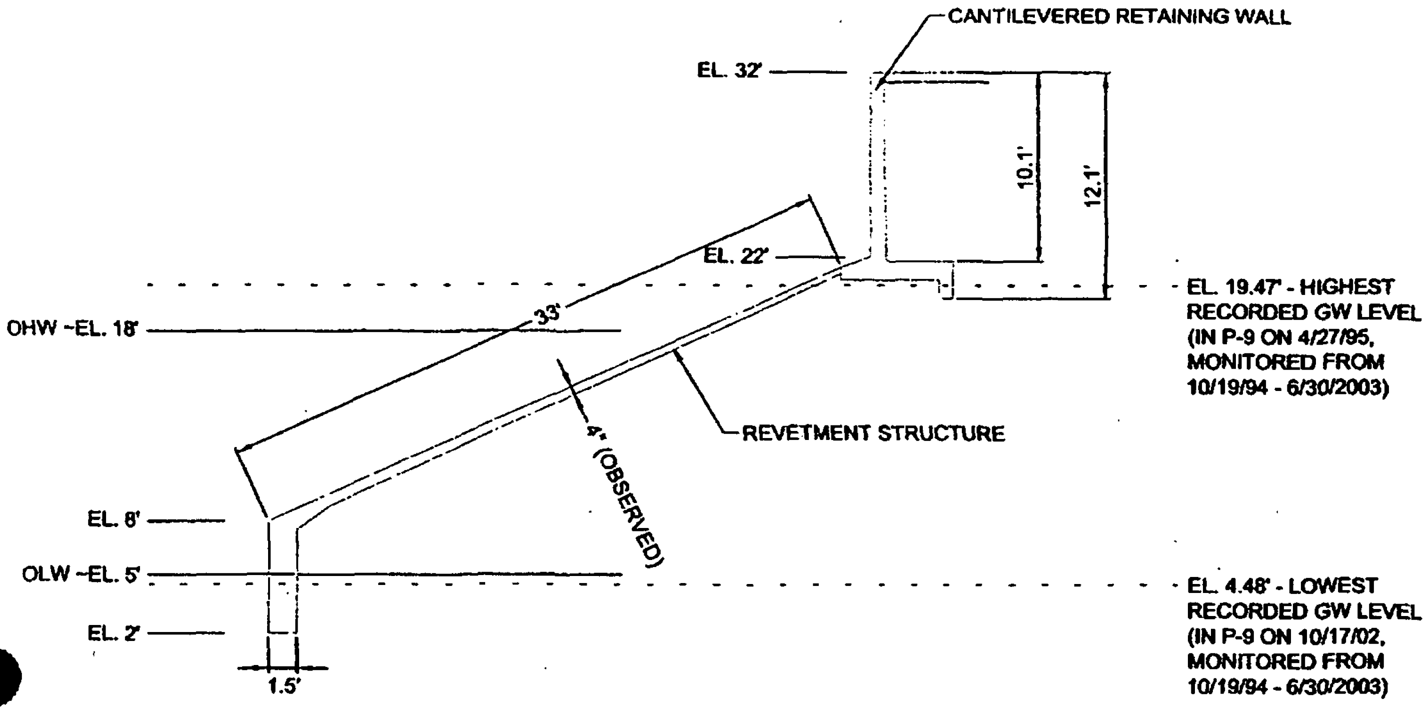
BP Arco Terminal 22T
Portland, Oregon

SOIL TPH RESULTS – REVETMENT AND GEOPROBE SAMPLES

FIGURE 3



URS	Job No. 33476051.00546 BP Arco Terminal 22T Portland, Oregon	CONCEPTUALIZED SECTION OF HYDROSRATIGRAPHIC UNITS	FIGURE 5



NOTE:
ELEVATIONS ARE APPROXIMATE &
RECORDED IN FEET MSL.

SECTION A: EXISTING SEAWALL GEOMETRY
SCALE: 1"=10'

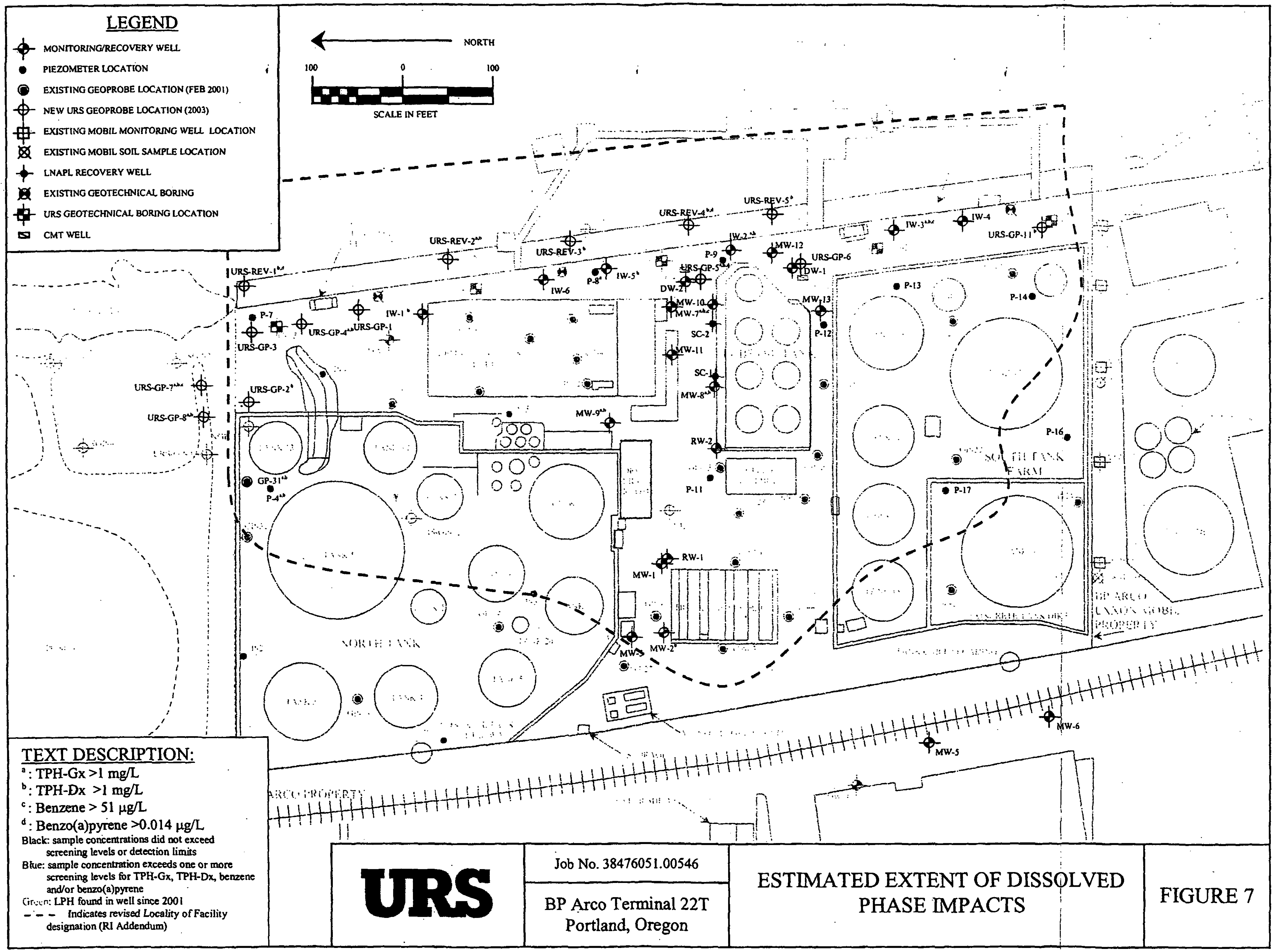
EXISTING SEAWALL GEOMETRY

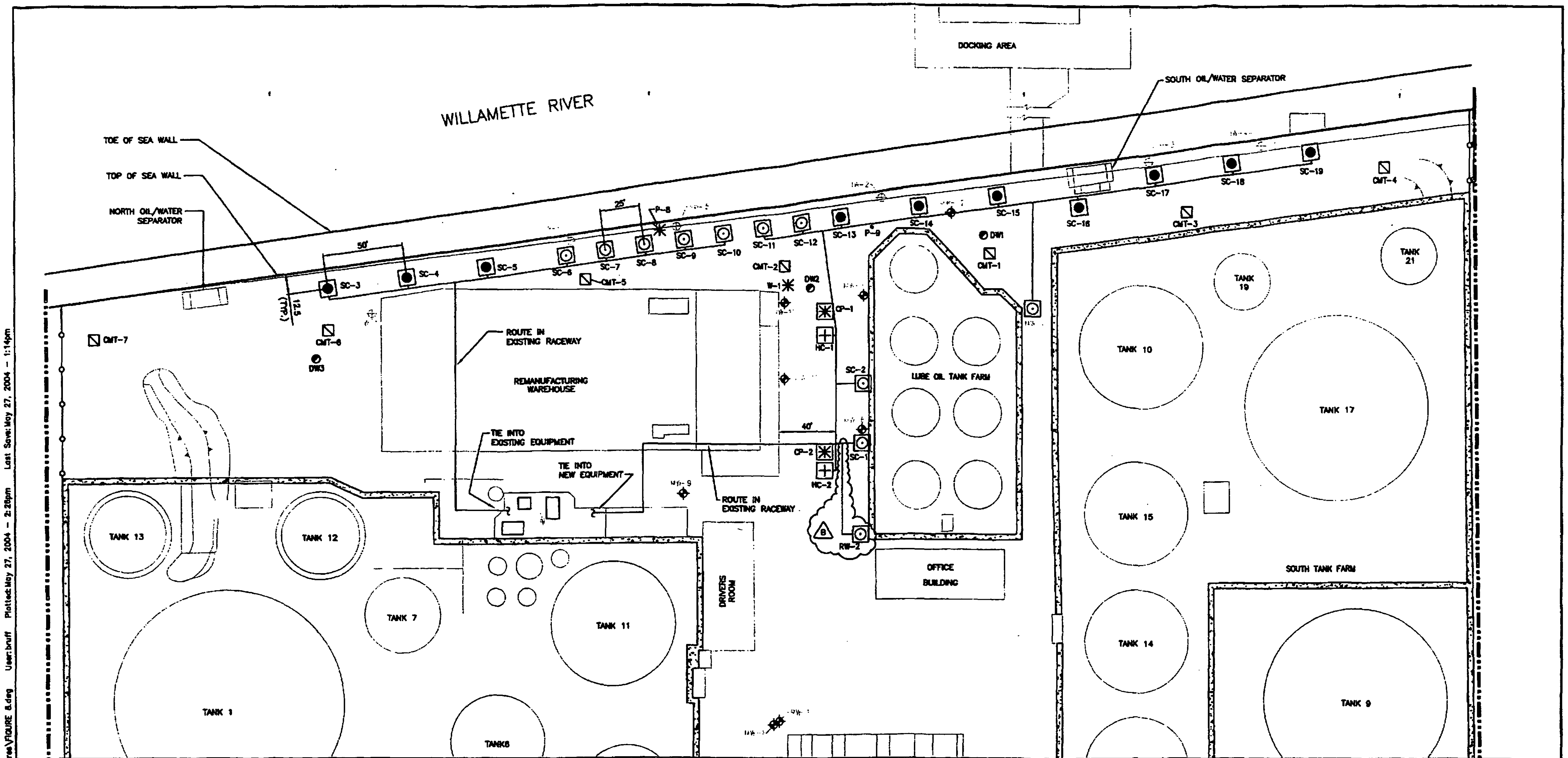
URS

MARCH 2004
38476051

BP/ARCO
TERMINAL 22
PORTLAND, OREGON

FIGURE 6


LEGEND
MONITORING/RECOVERY WELL
PIEZOMETER LOCATION
EXISTING GEOPROBE LOCATION (FEB 2001)
NEW URS GEOPROBE LOCATION (2003)
EXISTING MOBIL MONITORING WELL LOCATION
EXISTING MOBIL SOIL SAMPLE LOCATION
LNAPL RECOVERY WELL
EXISTING GEOTECHNICAL BORING
URS GEOTECHNICAL BORING LOCATION
CMT WELL
NORTH
100 0 100
SCALE IN FEET
URS-REV-1
URS-REV-2
URS-REV-3
URS-REV-4
URS-REV-5
URS-GP-1
URS-GP-2
URS-GP-3
URS-GP-4
URS-GP-5
URS-GP-6
URS-GP-7
URS-GP-8
URS-GP-11
IW-1
IW-2
IW-3
IW-4
IW-5
IW-6
MW-1
MW-2
MW-3
MW-5
MW-6
MW-7
MW-8
MW-9
MW-10
MW-11
MW-12
MW-13
RW-1
RW-2
SC-1
SC-2
DW-1
DW-2
P-4
P-7
P-8
P-9
P-11
P-12
P-13
P-14
P-16
P-17
GP-31
NORTH TANK
SOUTH TANK FARM
BP ARCO
EXXON MOBIL
PROPERTY
ARCO PROPERTY
TEXT DESCRIPTION:
a: TPH-Gx >1 mg/L
b: TPH-Dx >1 mg/L
c: Benzene > 51 µg/L
d: Benzo(a)pyrene >0.014 µg/L
Black: sample concentrations did not exceed screening levels or detection limits
Blue: sample concentration exceeds one or more screening levels for TPH-Gx, TPH-Dx, benzene and/or benzo(a)pyrene
Green: LPH found in well since 2001
Indicates revised Locality of Facility designation (RI Addendum)
URS
Job No. 38476051.00546
BP Arco Terminal 22T
Portland, Oregon
ESTIMATED EXTENT OF DISSOLVED PHASE IMPACTS
FIGURE 7



LEGEND

- ⊙ SKIMMER PUMPS (10)
- ● TOTAL FLUID PUMPS (10)
- • PIEZOMETER
- + HYDRAULIC CONTROL PUMPS WITH SKIMMERS (2)
- ⊕ EXISTING INTERCEPTOR WELLS (6)
- EXISTING WELLS
- □ CONCRETE ACCESS VAULT (19)
- ✳ CONTROL POINT WELLS (4)
- CMT WELLS (7)
- PRECAST CONCRETE TRENCH

30 0 30 60
SCALE IN FEET

No.	DATE	BY	REVISION
B	5/28/04	TRB	REVISED AND RE-ISSUED WITH BASIS OF DESIGN REPORT
A	3/31/04	SW	ISSUED WITH BASIS OF DESIGN REPORT

JOB No. 38476060	DESIGNED:	PROJ. ENGINEER:
SCALE: AS SHOWN	DRAWN BY:	APPROVED BY:
	CHECKED BY:	DATE: MARCH 04

WARNING
0 1/2 1
IF BAR DOES NOT MEASURE 1" AT FULL SIZE, THEN SCALES ON DRAWING NOT TO SCALE.

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BP ARCO TERMINAL 22

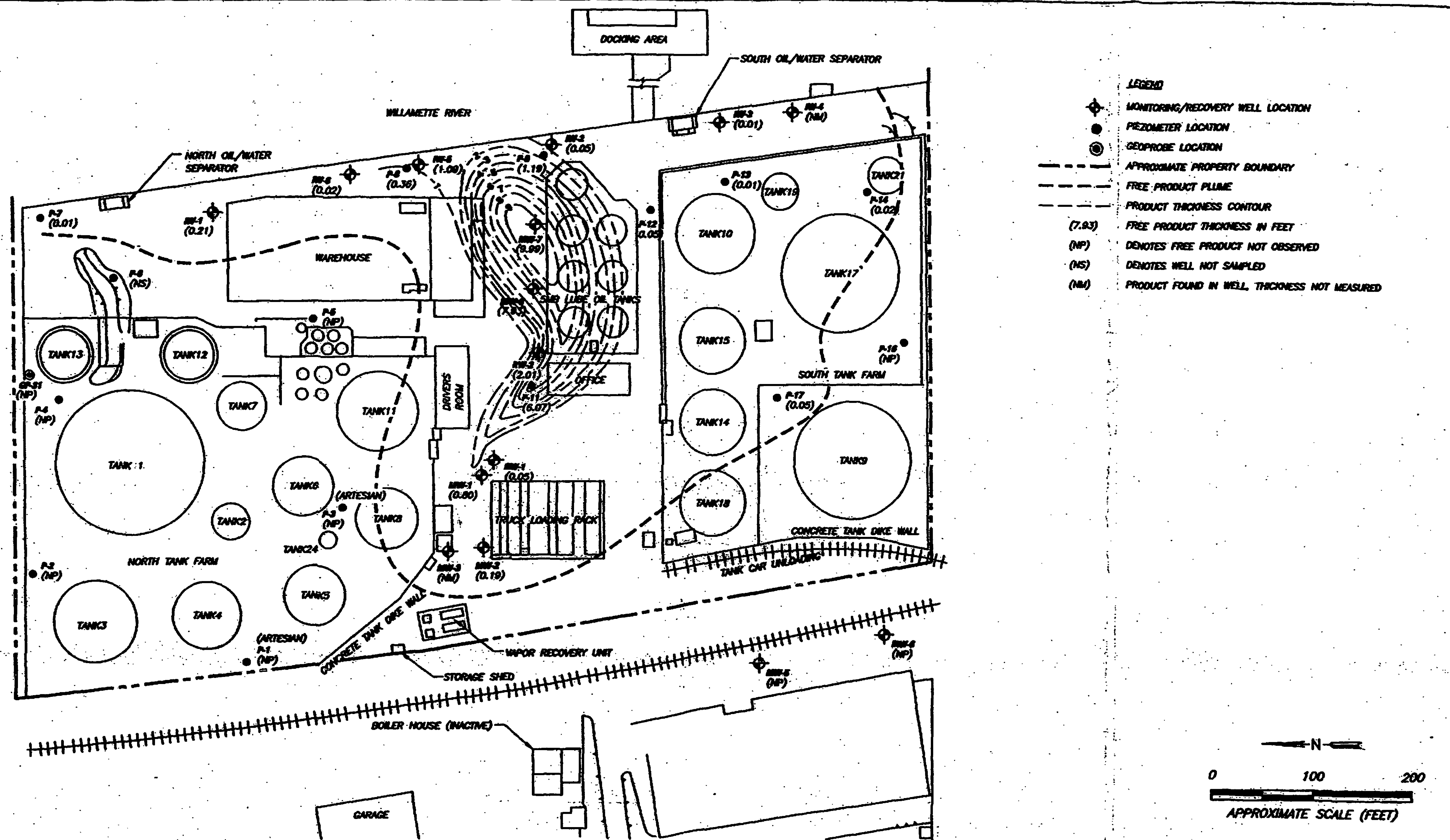
SCM BASIS OF DESIGN

SITE MAP INDICATING

SCM SYSTEM LAYOUT

DRAWING NUMBER: FIGURE 8
CAD FILE NUMBER: FIGURE 8
SHEET: OF
REV. B

O:\38475871 BP\Terminal 22\BOD\DRAFT BOD Report\Figures\FIGURE 8.dwg User:bruff Plotted:May 27, 2004 - 2:28pm Last Save:May 27, 2004 - 1:14pm



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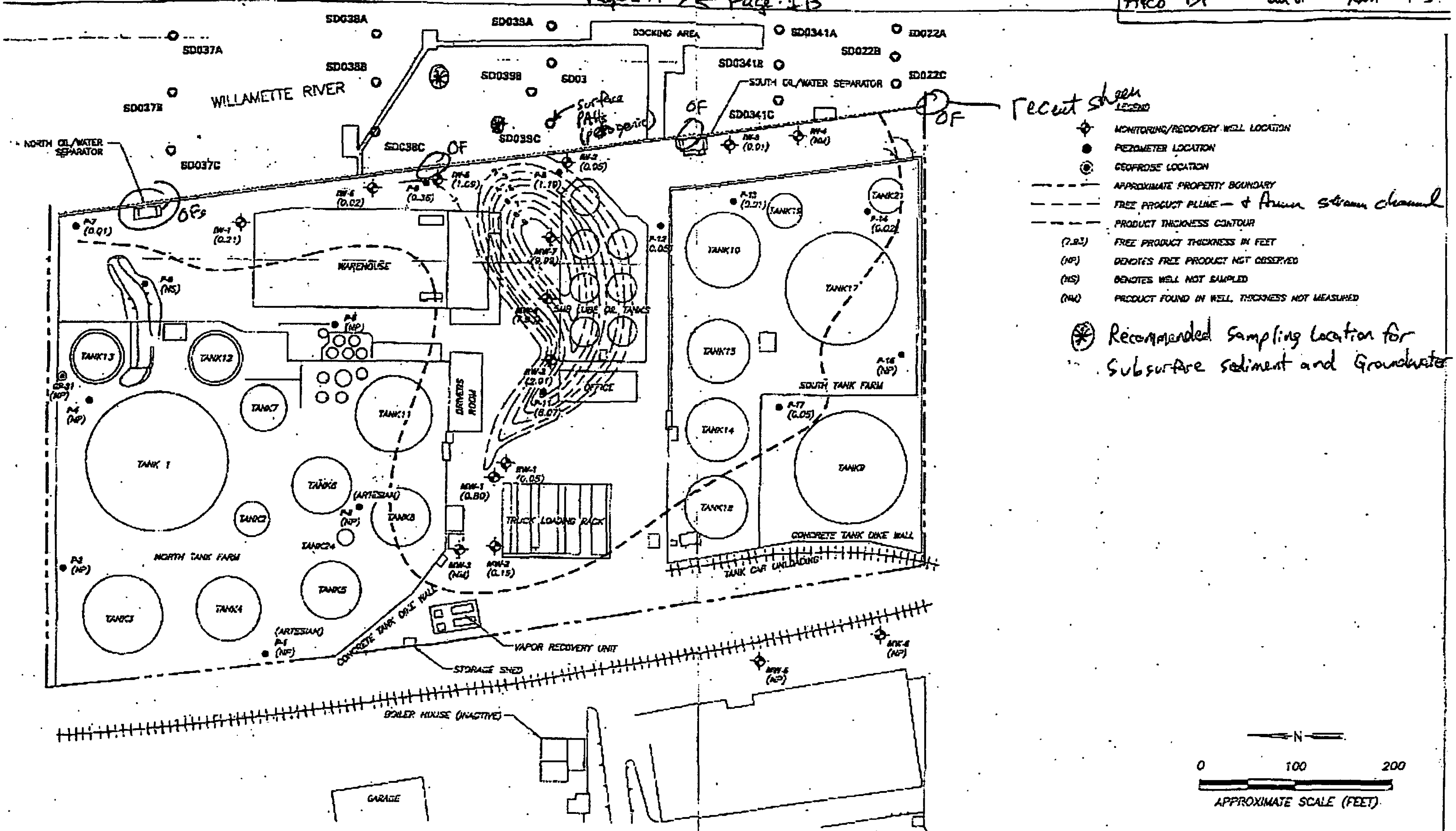
PRODUCT THICKNESS (FEET) BASED ON GROUNDWATER SAMPLING EVENT ON FEBRUARY 20, 2001
BP BULK TERMINAL 22T
9930 NW ST. HELENS ROAD
PORTLAND, OREGON

FIGURE: 9

JOB#: 15BP.60227.01.0248 | APPR: | DWN: KPM | DATE: 10/3/02

Page 1 A → ← Page 1 B

Arco BP Tank Rm 45



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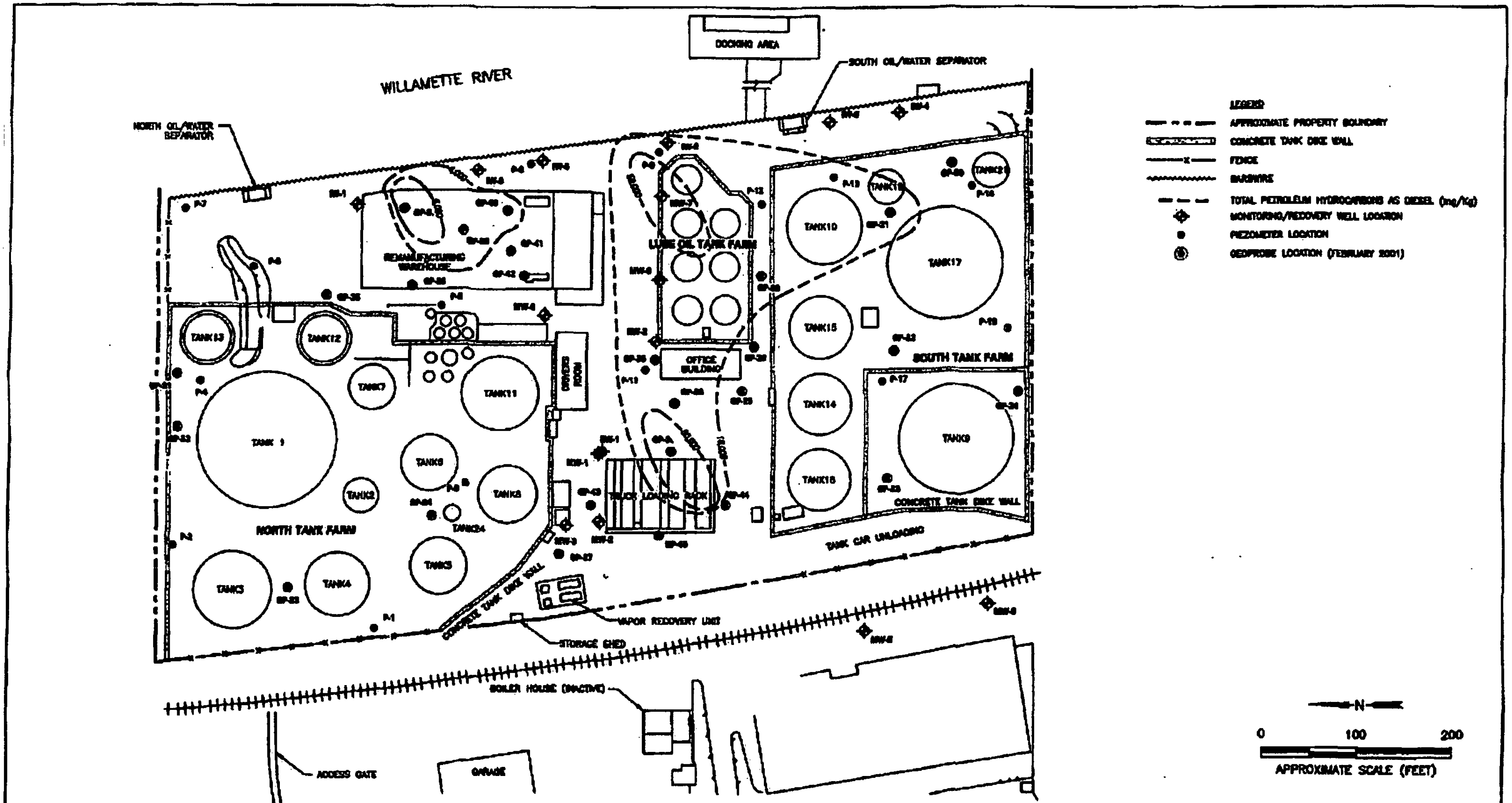
PRODUCT THICKNESS (FEET) BASED ON GROUNDWATER SAMPLING EVENT ON FEBRUARY 20, 2001
BP BULK TERMINAL 22T
9930 NW ST. HELENS ROAD
PORTLAND, OREGON

FIGURE: 9

JOB #: 158P.0622T.01.0248 | APPR: | DWN: KPM | DATE: 10/3/02



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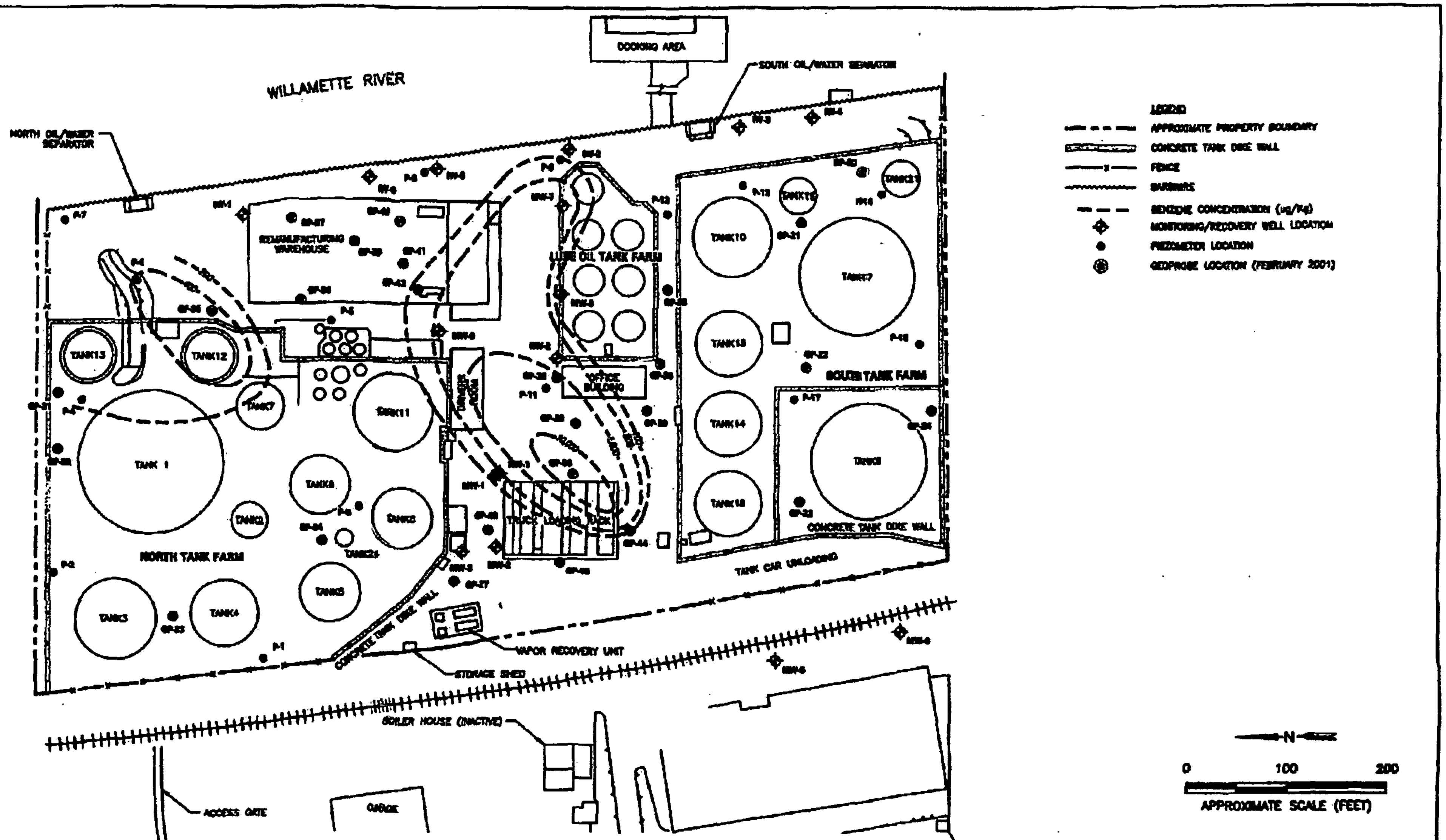
ISOCONTOUR MAP OF TPH-D CONCENTRATIONS IN SOILS FROM DEPTHS GREATER THAN 15 FEET (BGS)
BP BULK TERMINAL 22T
9930 NW ST. HELENS ROAD
PORTLAND, OREGON

FIGURE: 13

JOB #: [illegible] APPR: [illegible] DWN: [illegible] DATE: [illegible]

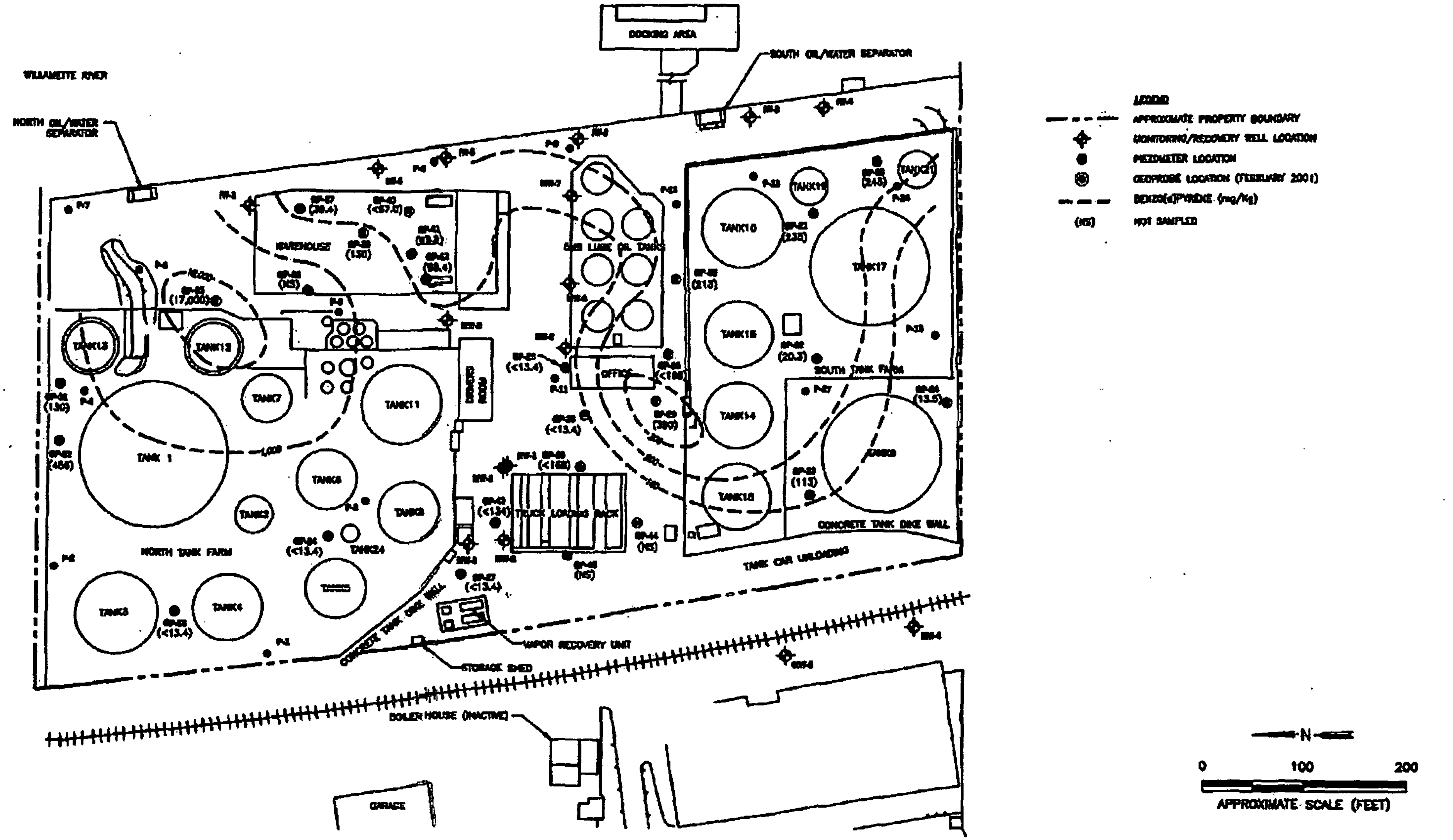


SECOR
International Incorporated

ISOCONTOUR MAP OF BENZENE CONCENTRATIONS IN SOILS FROM 8 TO 16 FEET (BGS)
BP BULK TERMINAL 22T
9930 NW ST. HELENS ROAD
PORTLAND, OREGON

FIGURE: 17

JOB#: APPR: SRH DWN: KPM DATE:

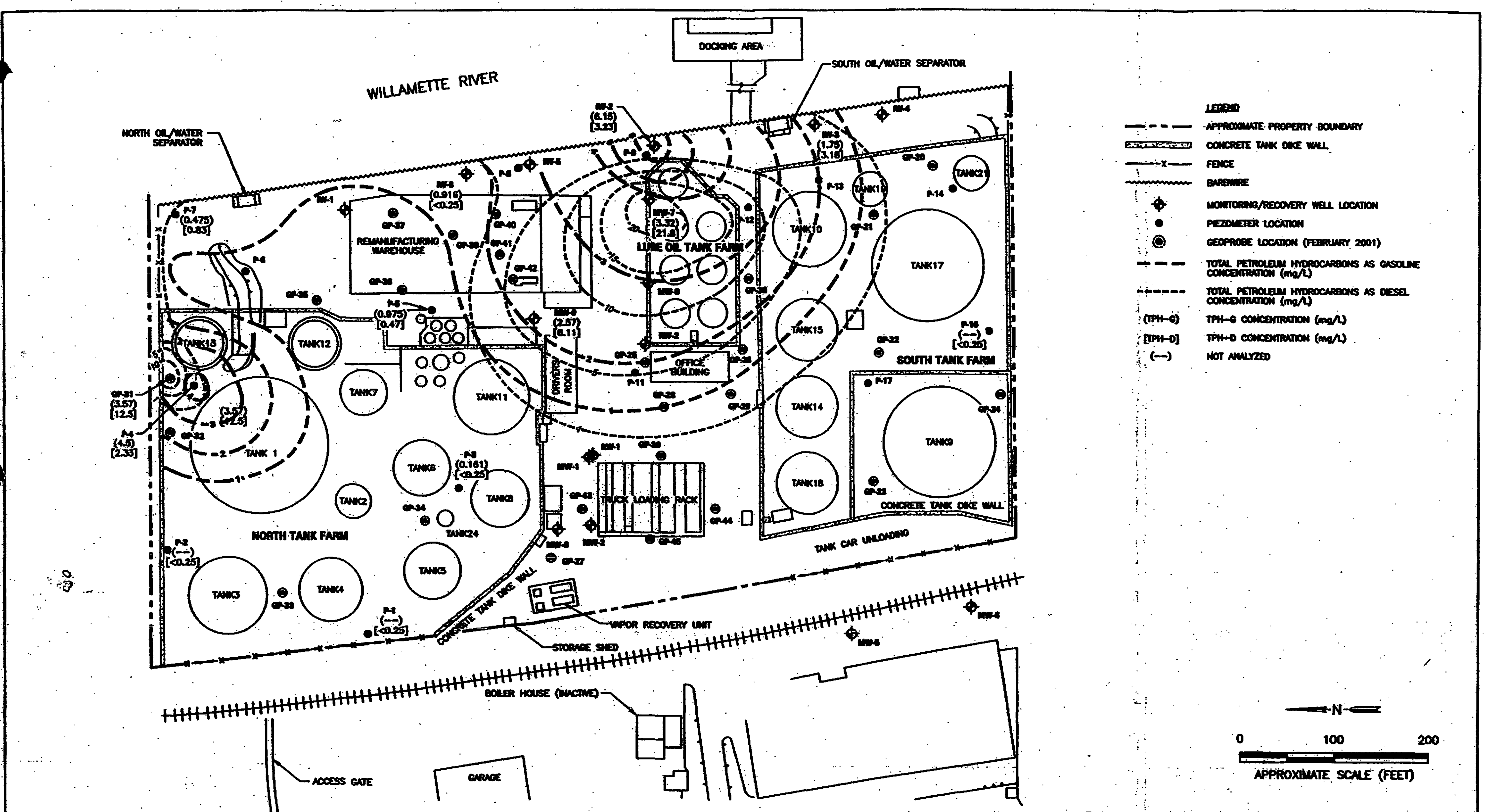


SECOR
International Incorporated

ISOCONTOUR MAP OF BENZO(a)PYRENE CONCENTRATIONS IN SOILS FROM 8 TO 16 FEET (BGS)
BP BULK TERMINAL 22T
9930 NW ST. HELENS ROAD
PORTLAND, OREGON

FIGURE: 20

JOB#: | APPR: | DWN: | DATE:

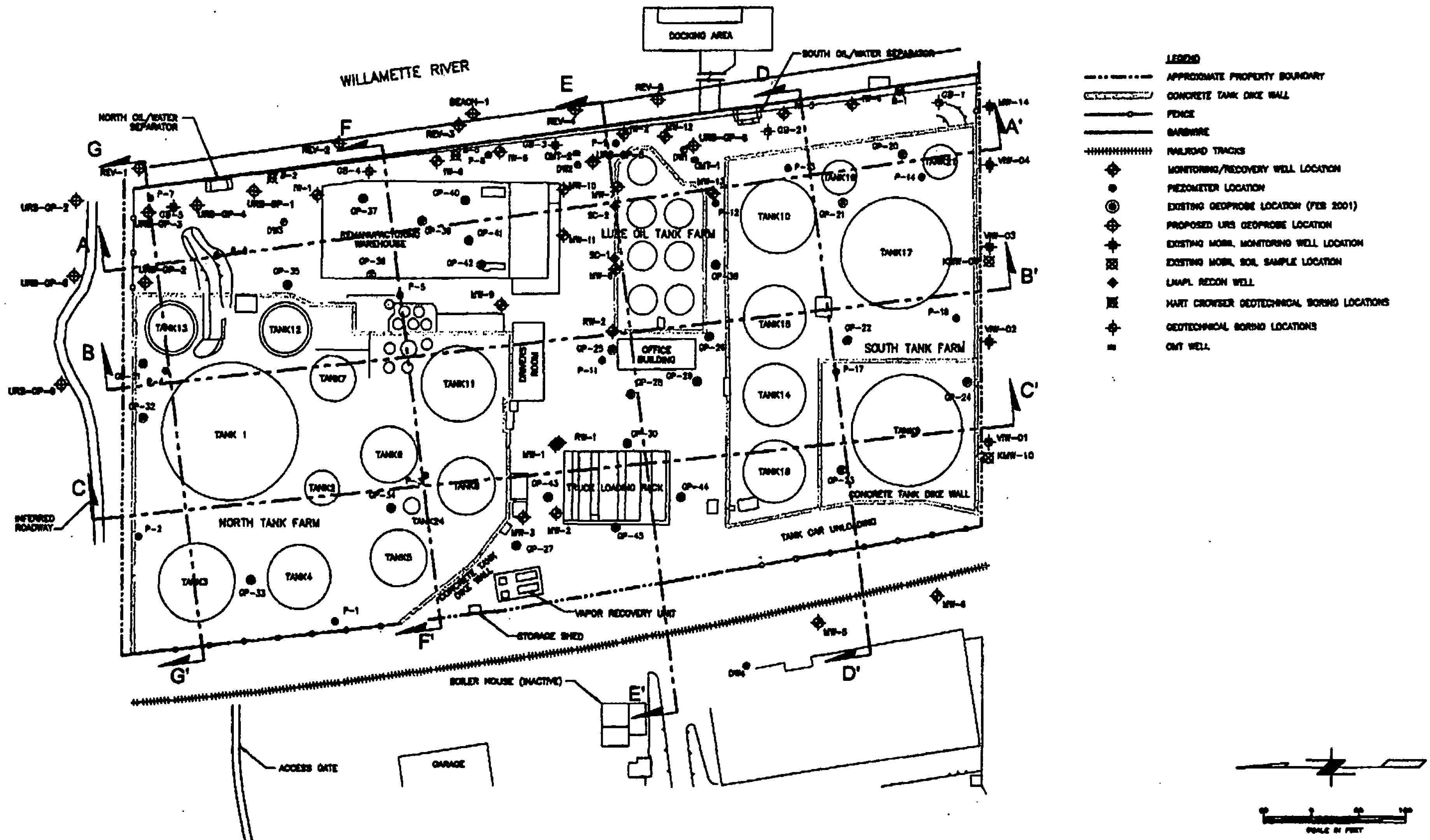


SECOR
International Incorporated

ISOCONTOUR MAP OF TPH-G AND TPH-D CONCENTRATIONS IN GROUNDWATER (02/21/01 AND 07/01/02)
BP BULK TERMINAL 22T
9930 NW ST. HELENS ROAD
PORTLAND, OREGON

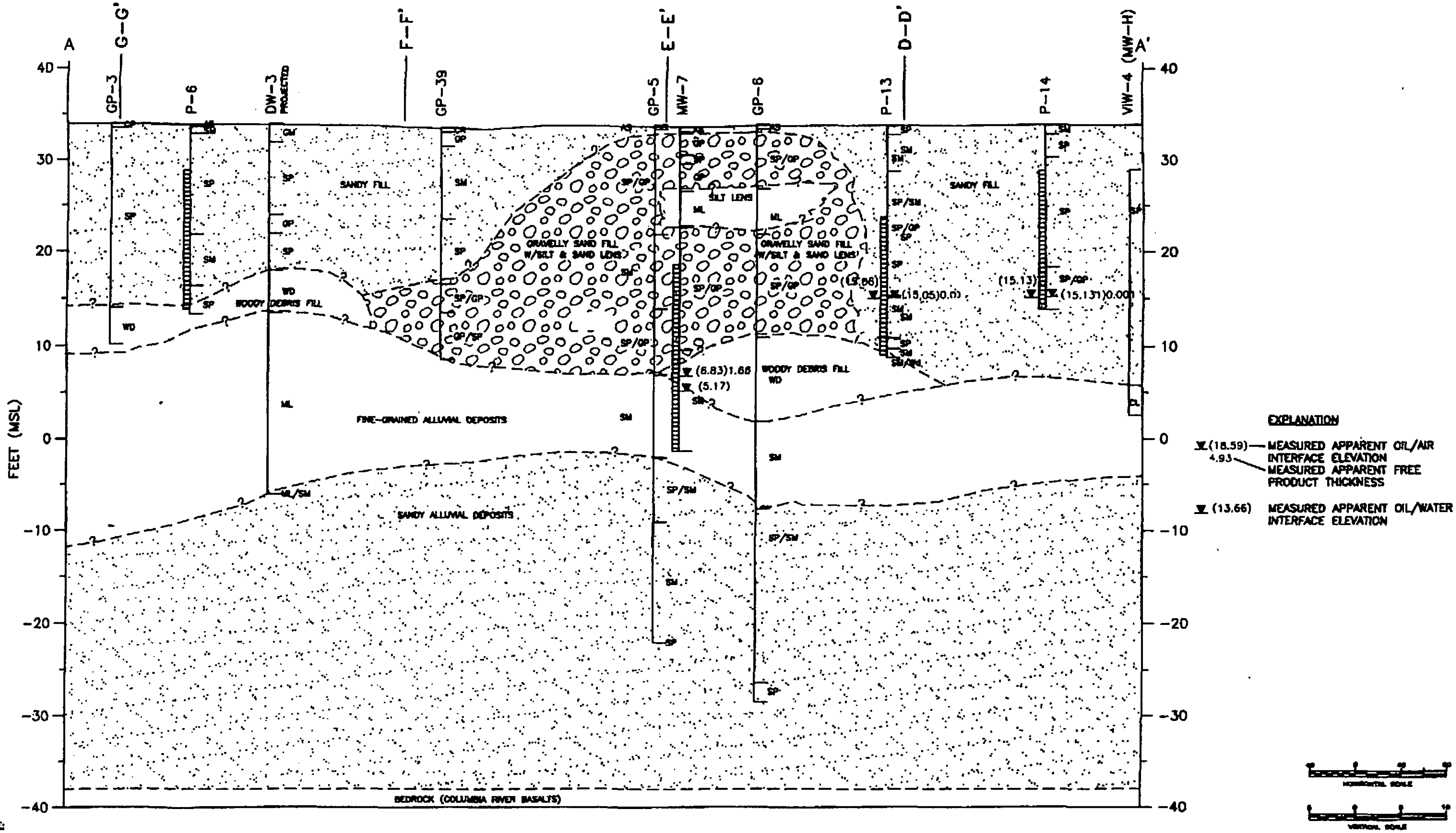
FIGURE: 35

JOB#: 15BP.0022T.01.0208 APPR: DWN: KPM DATE: 10/3/02



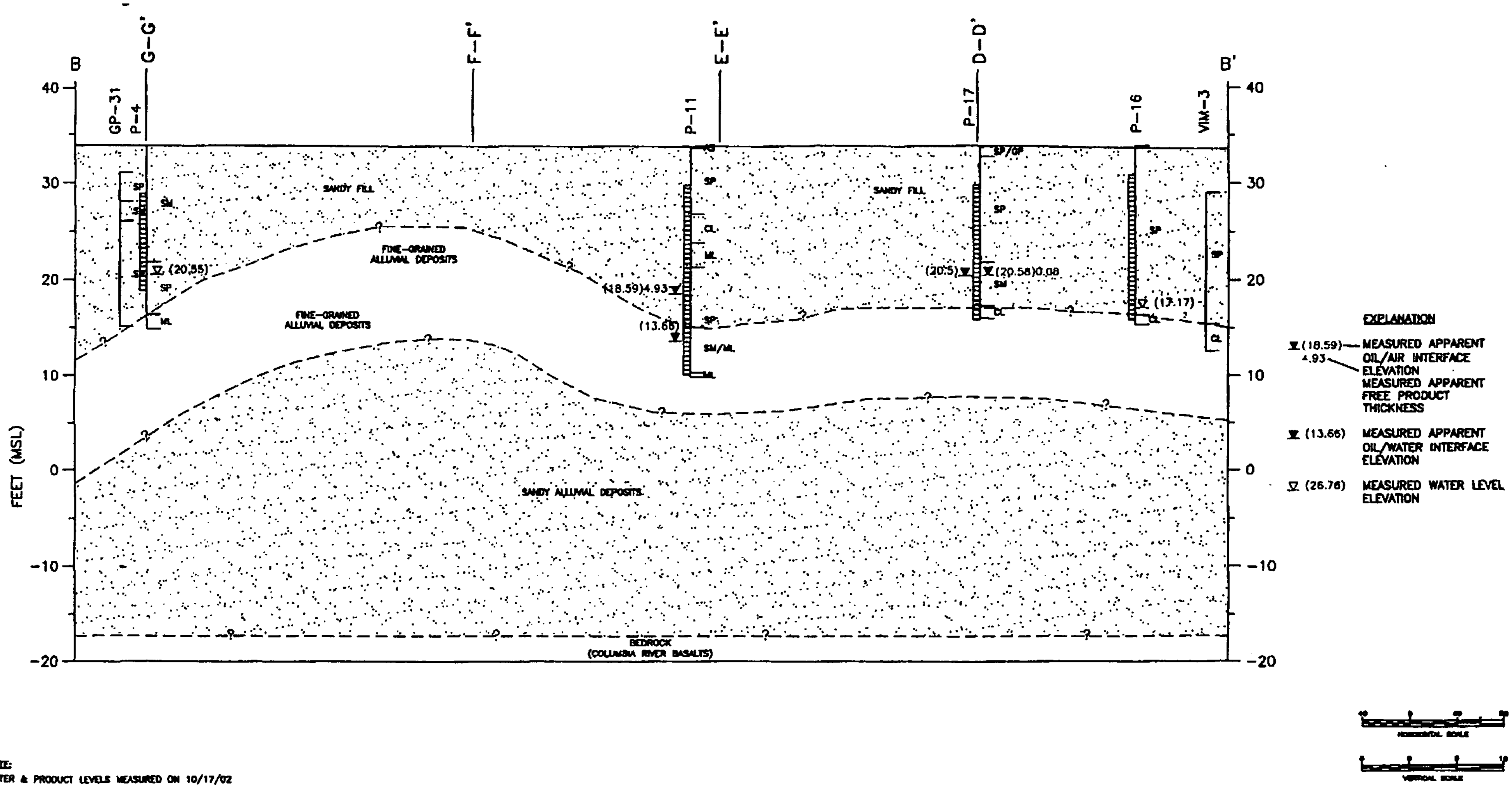
JOB No.	DESIGNED:	PROJ. ENGINEER:	URS	BP ARCO TERMINAL 22	SITE PLAN-VIEW MAP	DRAWING NUMBER: FIGURE 2-2
25479873			111 SW Columbia, Suite 900 Portland, Oregon 97201-5814 (tel) 503-222-7200 (fax) 503-222-4292 www.urscorp.com	GEOLOGIC INVESTIGATION PORTLAND, OREGON		CAD FILE NUMBER: FIGURE 2-2
SCALE: AS SHOWN	DRAWN BY: JDS	APPROVED BY:				SHEET: OF
	CHECKED BY:	DATE: AUG 2003				REV.: A

No.	DATE	BY	REVISION
A			



NOTE:
WATER & PRODUCT LEVELS MEASURED ON 10/17/02

URS	BP ARCO TERMINAL 22
GEOLOGIC INVESTIGATION PORTLAND, OREGON	HYDROGEOLOGIC CROSS SECTION A-A' SEE FIGURE 2-2 FOR LOCATION
SCALE: AS SHOWN	DATE: AUG 2003
DRAWN BY: JDB	FIGURE 4-1
REV. A	



NOTE:
WATER & PRODUCT LEVELS MEASURED ON 10/17/02

No.	DATE	BY	REVISION
A			

JOB No. 38478873
SCALE: AS SHOWN
DESIGNED:
DRAWN BY: JDS
CHECKED BY:
PROJ. ENGINEER:
APPROVED BY:
DATE: AUG 2003

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BP ARCO TERMINAL 22
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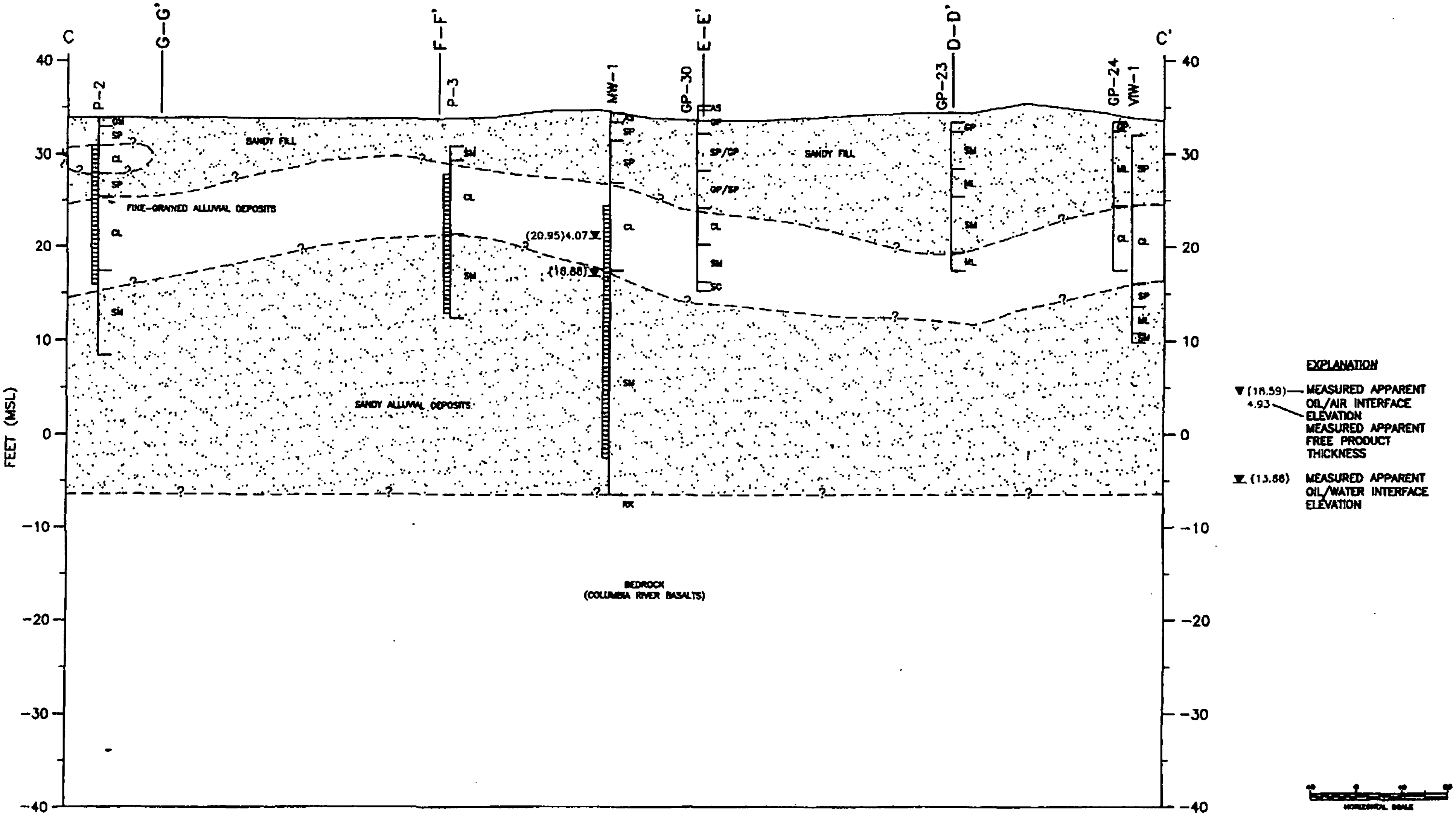
PORTLAND, OREGON

HYDROGEOLOGIC CROSS SECTION B-B'
SEE FIGURE 2-2 FOR LOCATION

DRAWING NUMBER: FIGURE 4-2
CAD FILE NUMBER: FIGURE 4-2
SHEET: OF
REV.: A



NOTE:
WATER & PRODUCT LEVELS MEASURED ON 10/17/02

JOB No.	38479873
SCALE:	AS SHOWN
DRAWN BY:	JCB
DATE:	AUG 2003

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BP ARCO TERMINAL 22

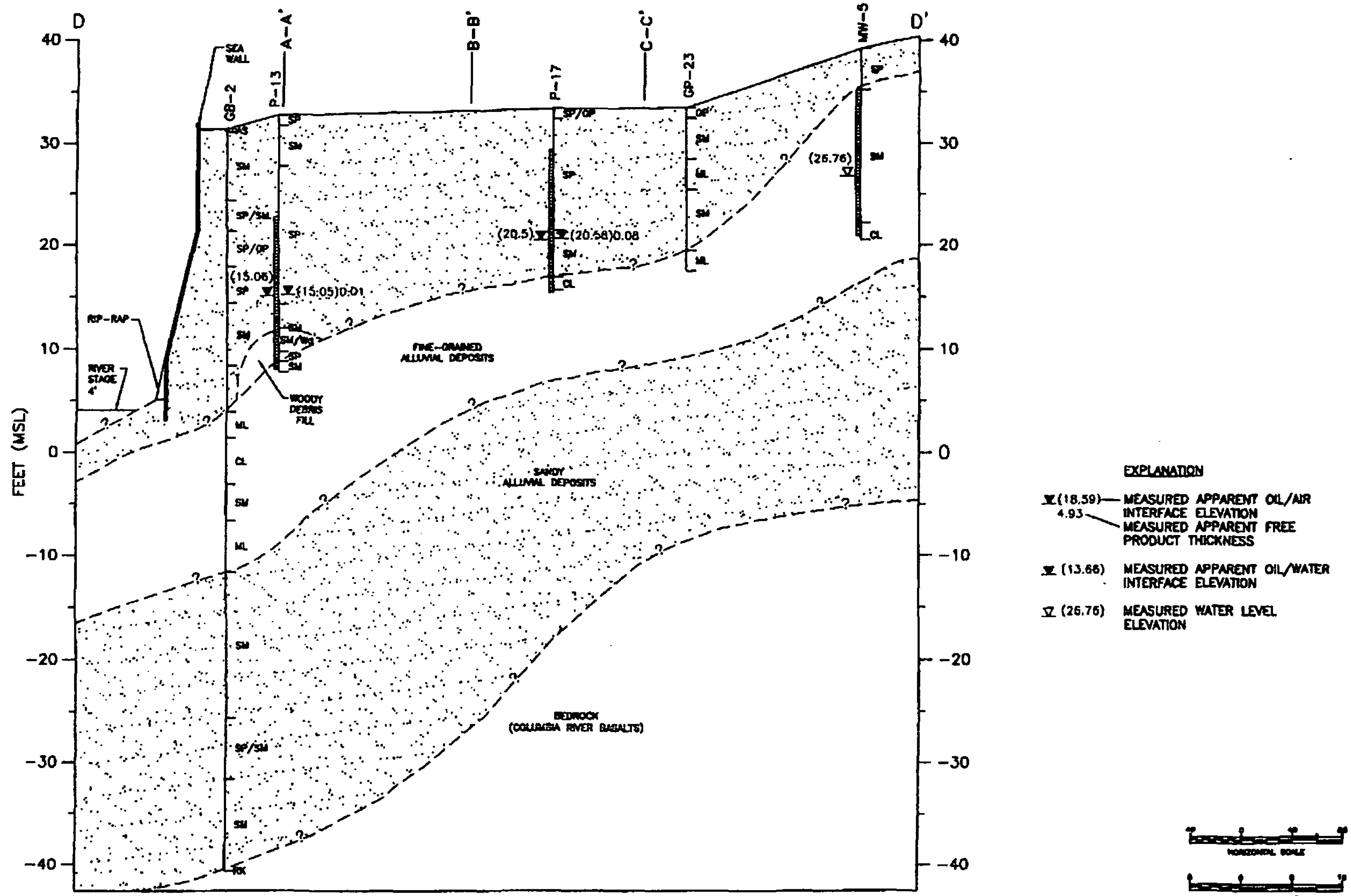
GEOLOGIC INVESTIGATION
PORTLAND, OREGON

HYDROGEOLOGIC CROSS SECTION C-C'

SEE FIGURE 2-2 FOR LOCATION

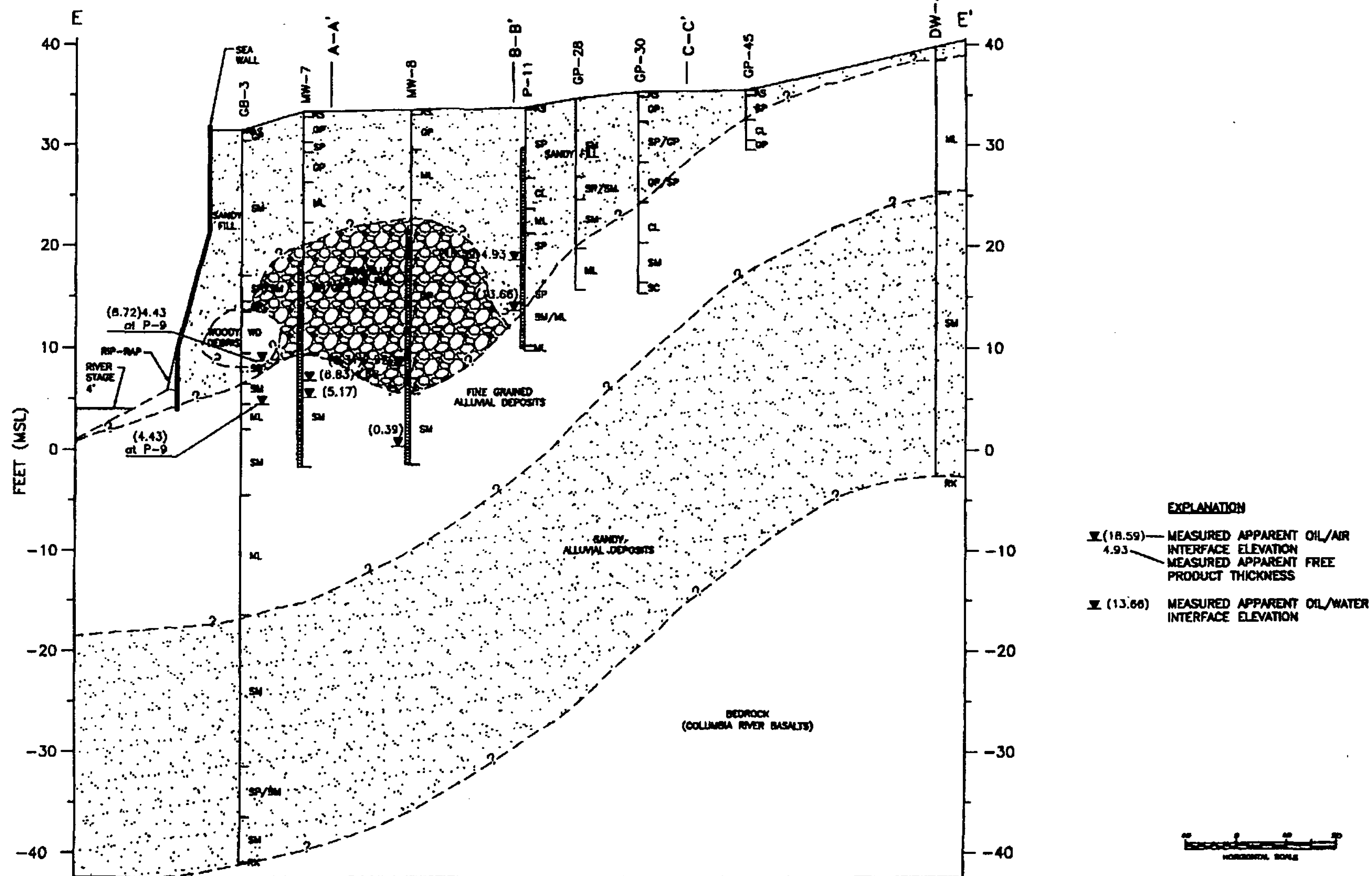
FIGURE 4-3

REV. A



NOTE:
WATER & PRODUCT LEVELS MEASURED ON 10/17/02

No.	DATE	BY	REVISION	JOB No. 25479873	DESIGNED	PROJ. ENGINEER		URS	BP ARCO TERMINAL 22	HYDROGEOLOGIC CROSS SECTION D-D'	DRAWING NUMBER FIGURE 4-4
				SCALE: AS SHOWN	DRAWN BY: JDB	APPROVED BY:	IF BAR DOES NOT MEASURE 1" AT FULL SIZE, THEN SCALE ON DRAWING NOT TO SCALE	111 SW Columbia, Suite 900 Portland, Oregon 97201-5814 (tel) 503-222-7200 (fax) 503-222-4292 www.urscorp.com	GEOLOGIC INVESTIGATION PORTLAND, OREGON	SEE FIGURE 2-2 FOR LOCATION	CAD FILE NUMBER FIGURE 4-4
					CHECKED BY:	DATE: AUG 2003					SHEET: OF / REV. A



NOTE:
WATER & PRODUCT LEVELS MEASURED ON 10/17/02

No.	DATE	BY	REVISION
A			

JOB No. 38475873
SCALE: AS SHOWN
DRAWN BY: JDS
CHECKED BY:
APPROVED BY:
DATE: AUG 2003

IF BAR DOES NOT MEASURE 1" AT FULL SIZE, THEN SCALE ON DRAWING NOT TO SCALE.

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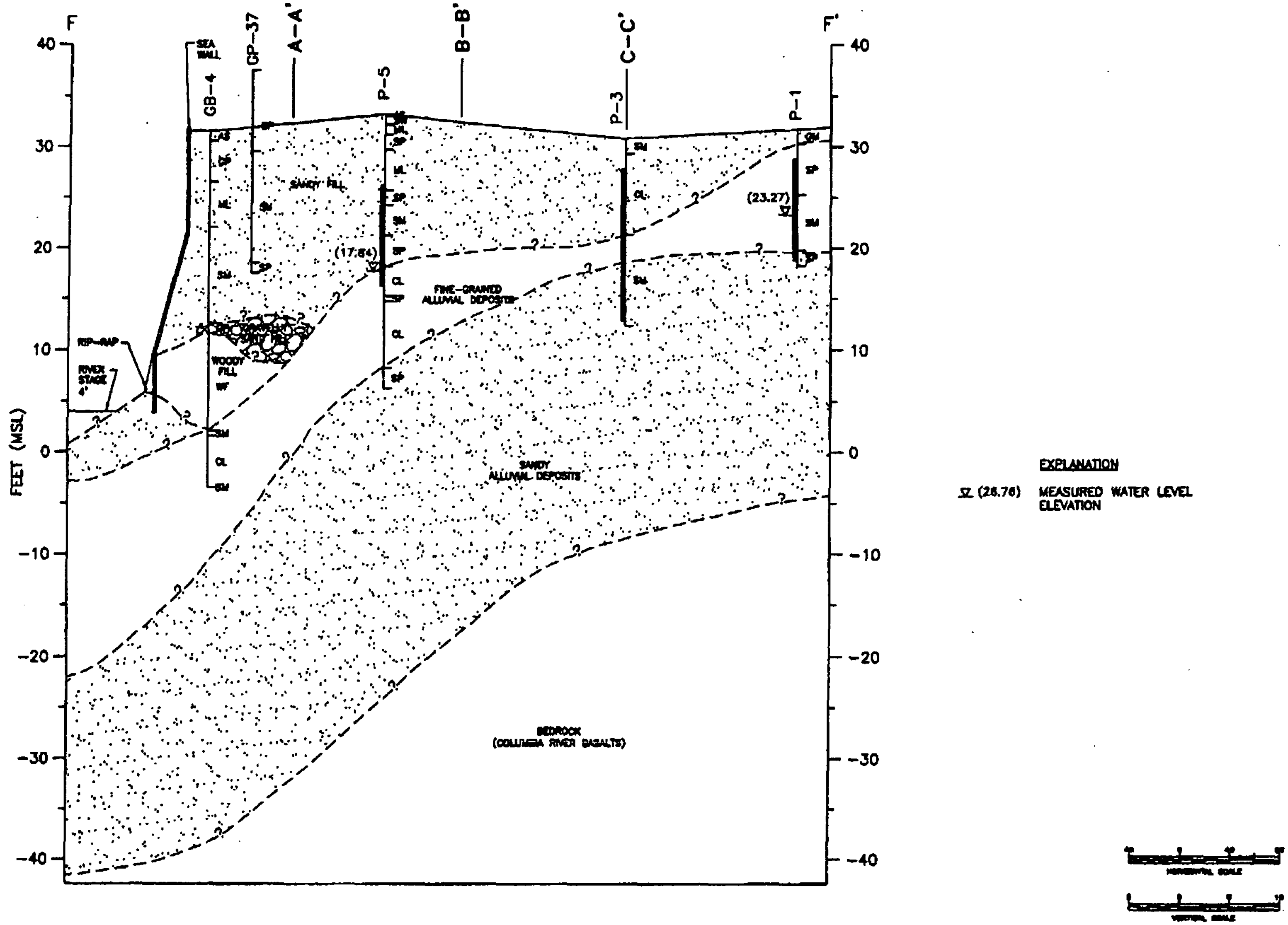
BP ARCO TERMINAL 22
GEOLOGIC INVESTIGATION
PORTLAND, OREGON

HYDROGEOLOGIC CROSS SECTION E-E'
SEE FIGURE 2-2 FOR LOCATION

DRAWING NUMBER: FIGURE 4-5
CAD FILE NUMBER: FIGURE 4-5
REV. A



NOTE:
WATER & PRODUCT LEVELS MEASURED ON 10/17/02

No.	DATE	BY	REVISION
A			

JOB No. 30478073	DESIGNED:	PROJ. ENGINEER:	
SCALE: AS SHOWN	DRAWN BY: JDS	APPROVED BY:	
	CHECKED BY:	DATE: AUG 2003	

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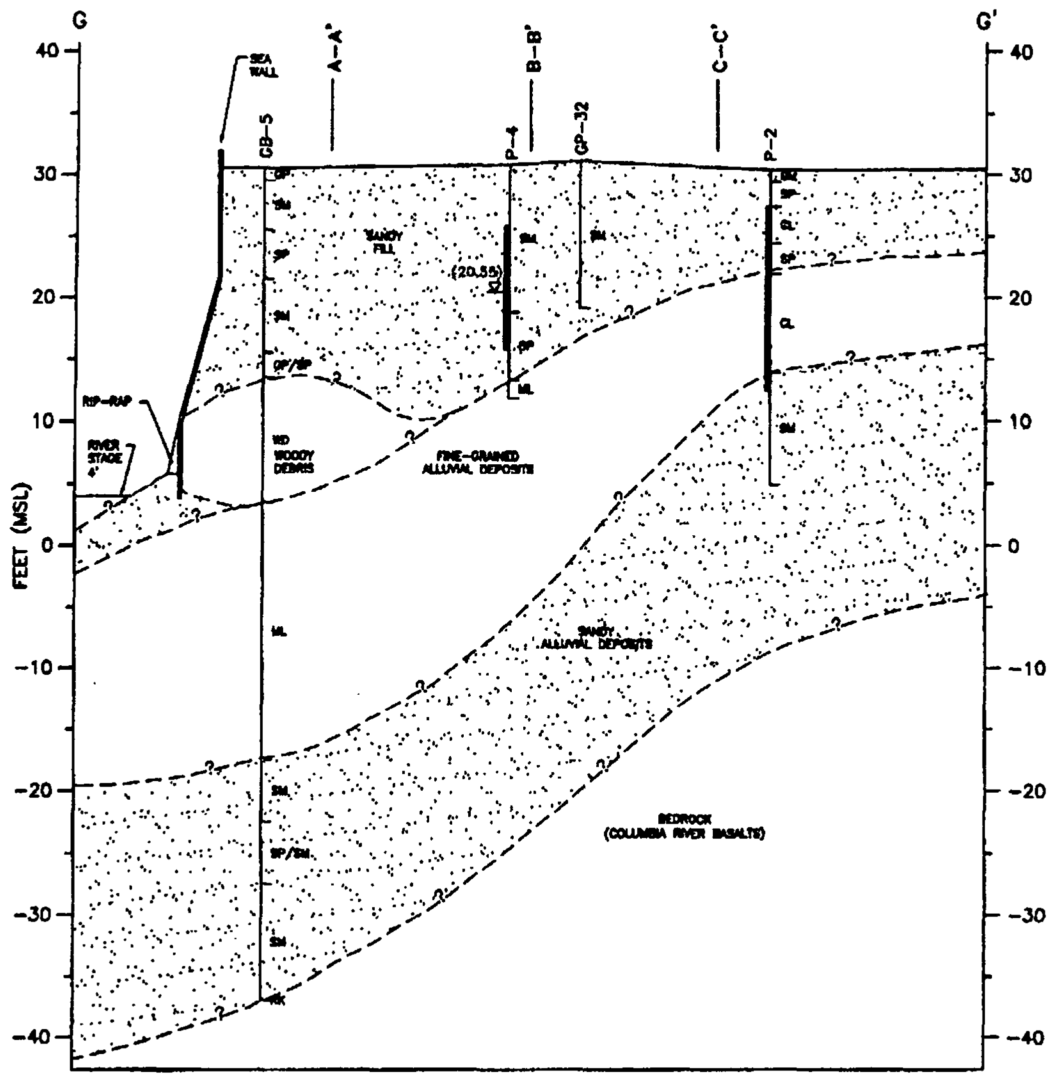
BP ARCO TERMINAL 22

GEOLOGIC INVESTIGATION
PORTLAND, OREGON

HYDROGEOLOGIC CROSS SECTION F-F'

SEE FIGURE 2-2 FOR LOCATION

FIGURE 4-6
FIGURE 4-6
OF
A

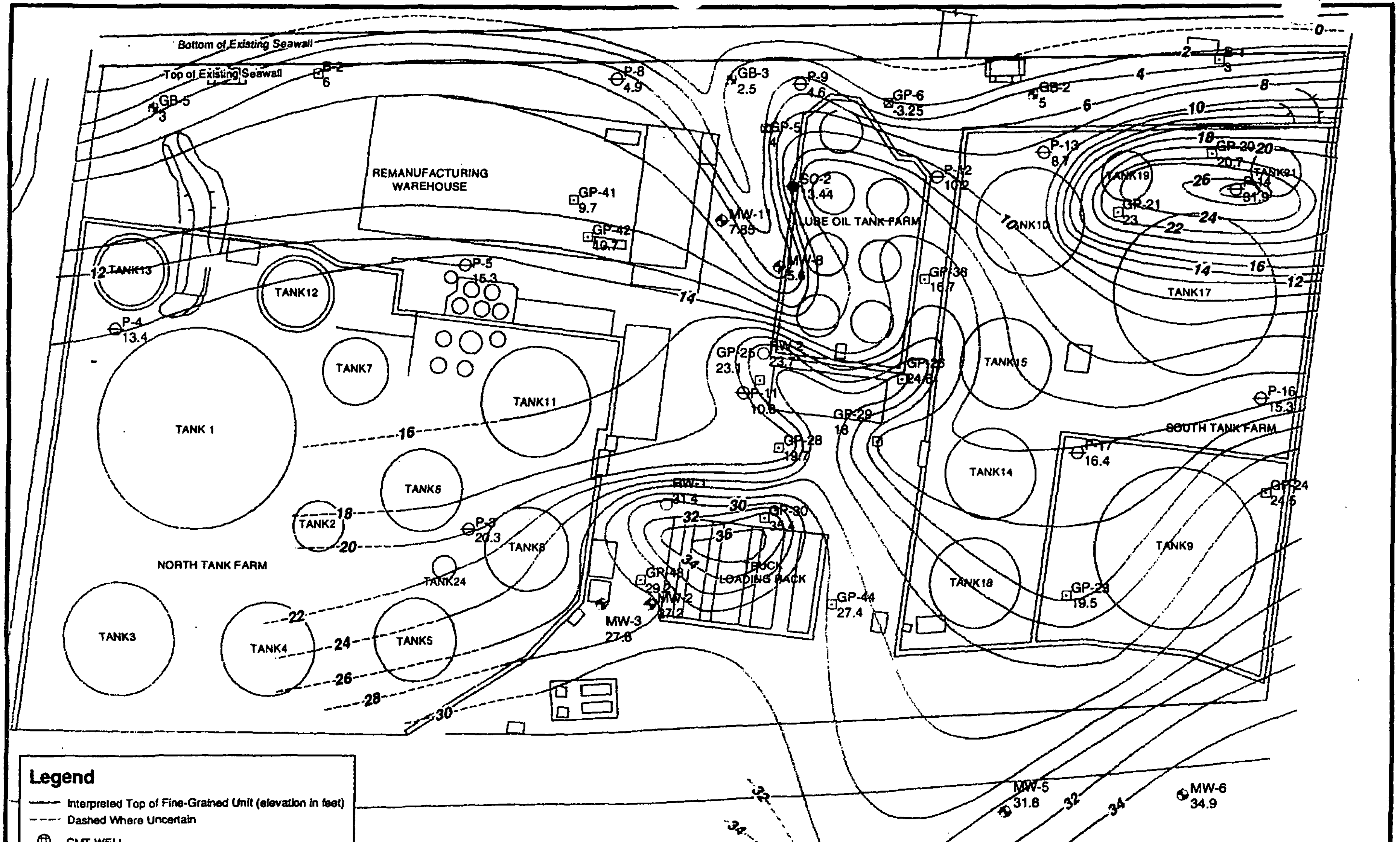


EXPLANATION

(26.76) MEASURED WATER LEVEL ELEVATION

NOTE:
WATER & PRODUCT LEVELS MEASURED ON 10/17/02

SCALE: AS SHOWN	DRAWN BY: JOE	DATE: AUG 2002	URS
BP ARCO TERMINAL 22	GEOLOGIC INVESTIGATION PORTLAND, OREGON	HYDROGEOLOGIC CROSS SECTION G-G'	SEE FIGURE 2-2 FOR LOCATION
FIGURE 4-7	FIGURE 4-7	REV. A	



Legend

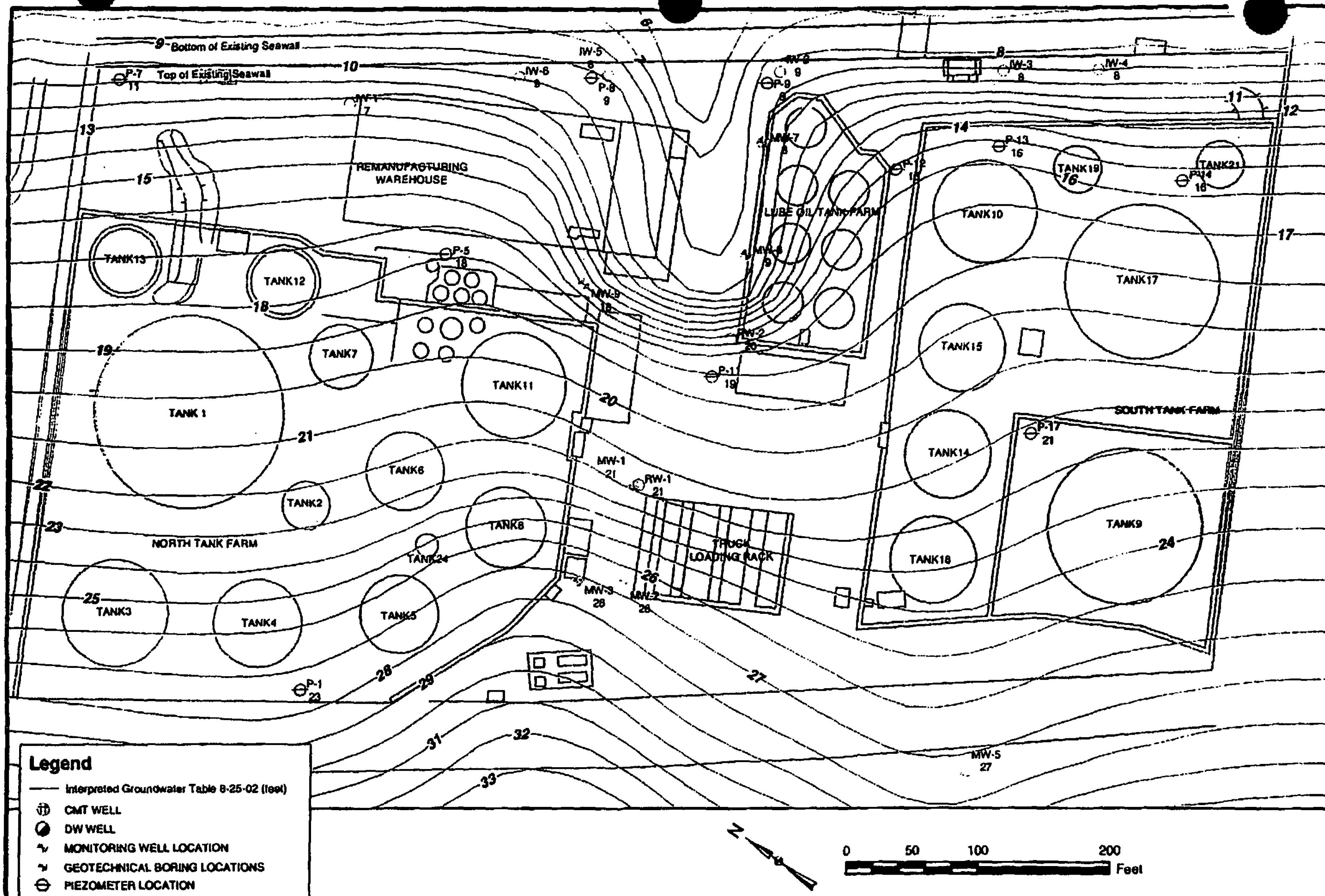
- Interpreted Top of Fine-Grained Unit (elevation in feet)
- Dashed Where Uncertain
- CMT WELL
- DW WELL
- MONITORING WELL LOCATION
- GEOTECHNICAL BORING LOCATIONS
- PIEZOMETER LOCATION
- EXISTING GEOPROBE LOCATION (FEB 2001)
- URS GEOPROBE
- INTERCEPTION WELL
- LNAPL RECOVERY WELL
- Seawall

NOTES:
MW-3 = Location name
27.8 = Estimated base elevation of fill based on boring logs

N

0 50 100 200 Feet

URS	BP ARCO TERMINAL 22	Figure 4-8 Interpreted Elevation of Base of Filled Materials	FILE NAME bp04002.mxd
111 SW Columbia, Suite 900 Portland, Oregon 97201-5814 (tel) 503-222-7200 (fax) 503-222-4292 www.urscorp.com	PORTLAND, OREGON GEOLOGIC INVESTIGATION		LAST REVISION DATE March 2004
			DR BY JLC - DEN



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(fax) 503-222-4292
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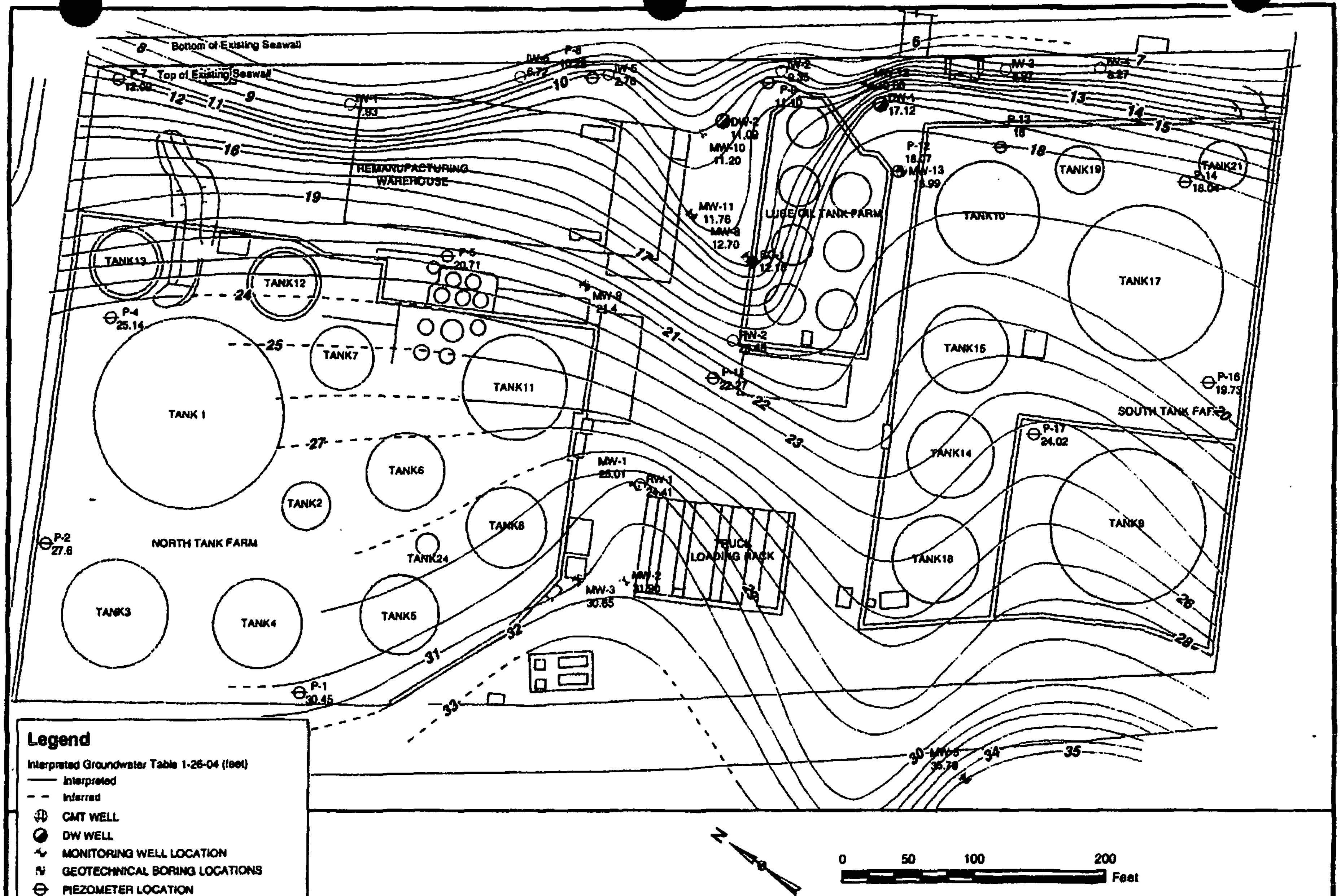
BP ARCO TERMINAL 22

PORTLAND, OREGON
GEOLOGIC INVESTIGATION

Figure 4-11
Interpreted Equivalent Groundwater Table on August 25, 2002, Low Flow Conditions

FILE NAME
bp04003.mxd
LAST REVISION DATE
March 2004
DR BY
JLC - DEN



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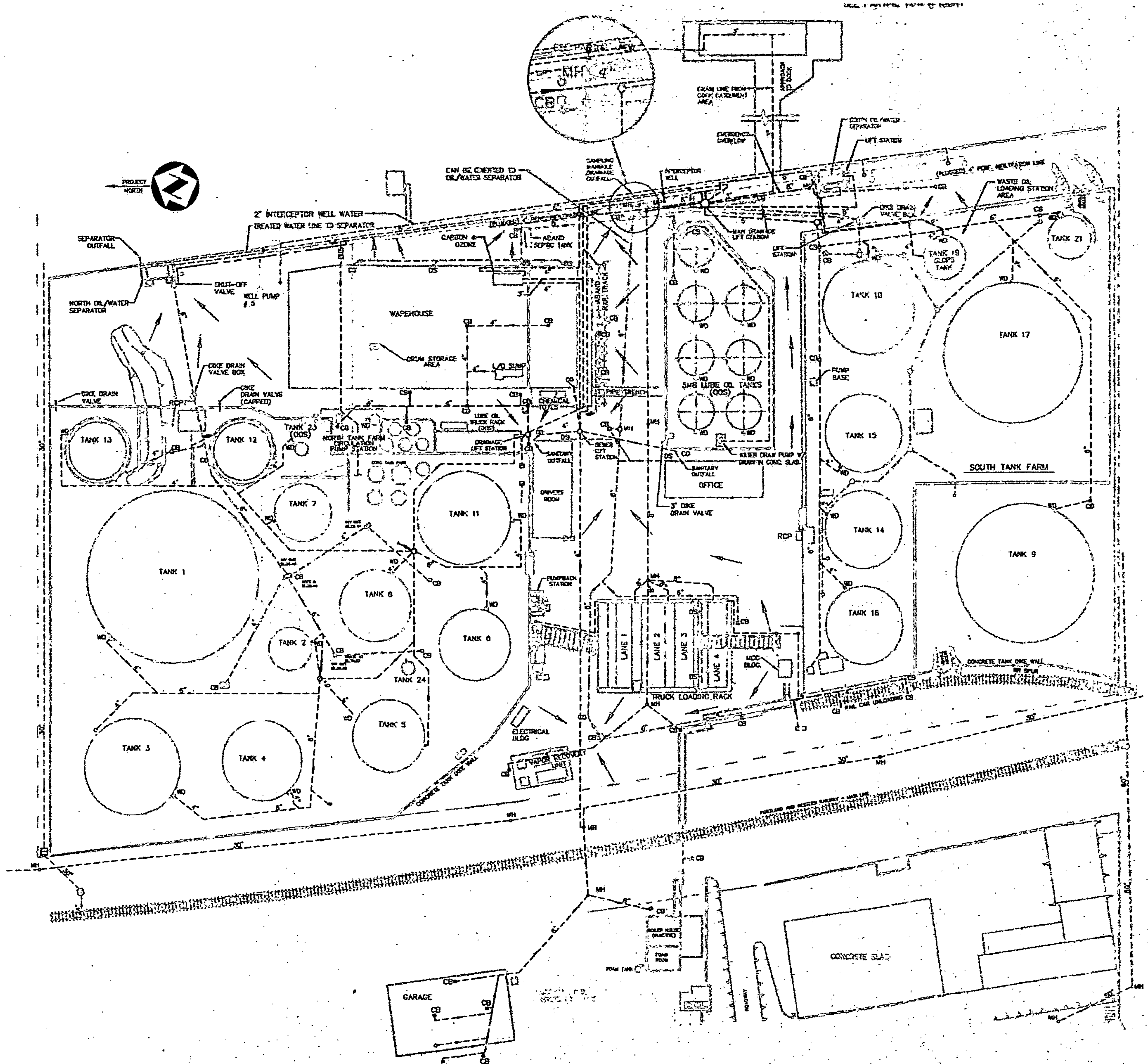
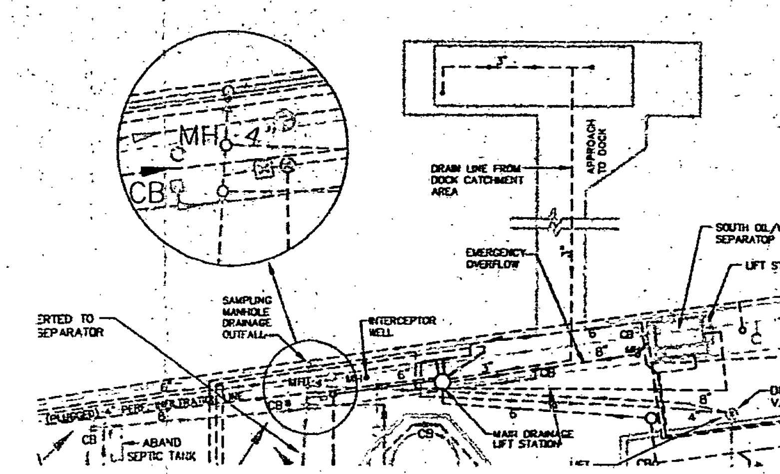
GEOLOGIC INVESTIGATION

Figure 4-12
Interpreted Equivalent Groundwater Table on January 24, 2004 High Flow Conditions

FILE NAME	bp04004.mxd
LAST REVISION DATE	March 2004
DR BY	JLC - DEN



PLAN VIEW



PARTIAL VIEW

LEGEND:

WD = WATER DRAW
MH = MANHOLE
CB = CATCH BASIN
WP = WELL PUMP
RCP = OIL FILLED CATHODIC PROTECTION RECTIFIER — RCP
SURFACE DRAINAGE

PROCESS WATER
STORM WATER
SANITARY EFFLUENT
GROUND WATER
TREATED WATER

NOTES:

1.) ALL PIPING IS SHOWN UNDERGROUND. FOR ABOVEGROUND PIPING (SEE 10110968).
2.) ELEVATION DATUM IS CITY OF PORTLAND, BASED ON CITY OF PORTLAND BENCH MARKNo. 1428 = EL. 32.25' (SEE DWG PO-P-93T13).
3.) COORDINATES ARE BASED ON THE OUTSIDE OF THE NORTH WALL OF THE NORTH TANK FARMDIKE
WEST END N.6000.00 E.10000.00 EAST END N. 6000.00 E.374.99
(SEE DWG PO-P-93T12)

0 40 80 120
SCALE: 1"=40'-0"

REFERENCE DRAWINGS		REVISION SECTION							
DWG NO.	DESCRIPTION	REV.	DATE	REVISIONS	AFC	DIAG. NO.	BY	CHK	APR
		0	6-17-03	UPDATE PER 2003 SPCC WALKDOWN	M833	N/A	LH	PT	K.B.

OLD DWG NO:

BP West Coast Products LLC

PORTLAND
ENVIRONMENTAL COMPLIANCE
TANK FARM – GENERAL SITE PLAN

SCALE: 1"=40' TYPE:3 SUBTYPE: 71

DRAWING NO. PO-1-G-10110969 REVISI

INDEX REV 1

SUPPLEMENTAL TABLES

Table 2. SECOR, Summary Statistics for Groundwater Contaminants of Interest. (Appendix D, October 2002)

Table 5. Summary Statistics for Groundwater Contaminants of Interest
BP Terminal 22T
9930 NW St. Helens Road, Portland, Oregon

[illegible]	COI	Mean (µg/L)	Minimum (µg/L)	Maximum Detected (µg/L)	Location of Maximum Detection	Number of Samples Analyzed	Number of Detections	Frequency
VOCs[d]	Benzene	11.1	<0.5	104[b]	IW-3	13	6	46%
	Toluene	0.99	<0.5	4.9	IW-3	13	6	46%
	Ethyl benzene	0.71	<0.5	2.84	IW-3	13	3	23%
	Xylenes (Total)	1.18	<1.0	4.7	IW-1	13	4	31%
	Acetone	18.8	<10	45.2	IW-6	4	1	25%
	MTBE	16.7	7.03	35.3	IW-2	4	4	100%
	n-Butylbenzene	9.24	<5.0	17	P-7	4	3	75%
	sec-Butylbenzene	4.63	1.08	8.9	IW-2	4	4	100%
	tert-Butylbenzene	0.66	<1.0	1.13	IW-2	4	1	25%
	Isopropylbenzene	11.7	2.03	24.5	IW-3	4	4	100%
	n-propylbenzene	23.1	<1.0	51.9	IW-3	4	3	75%
PAHs[e]	Acenaphthene	1.70	0.256	4.90	IW-1	13	12	92%
	Acenaphthylene	NC	<0.10	<2.5	NA	13	0	0%
	Anthracene	0.33	<0.10	0.17	P-7	13	5	38%
	Benzo (a) anthracene	0.15	<0.10	0.481	IW-6	13	1	8%
	Benzo (a) pyrene	0.14	<0.10	0.397	IW-6	13	1	8%
	Benzo (b) fluoranthene	0.15	<0.10	0.437	IW-6	13	1	8%
	Benzo (ghi) perylene	0.13	<0.10	0.27	IW-6	13	1	8%
	Benzo (k) fluoranthene	0.14	<0.10	0.375	IW-6	13	1	8%
	Chrysene	0.16	<0.10	0.608	IW-6	13	1	8%
	Dibenz (a,h) anthracene	NC	<0.20	<2.0	NA	13	0	0%
	Fluoranthene	0.49	<0.10	1.41	P-7	13	6	46%
	Fluorene	2.20	0.198	5.78	IW-1	13	13	100%
	Indeno (1,2,3-cd) pyrene	0.13	<0.10	0.246	IW-6	13	1	8%
	Naphthalene	NC	<0.5	<5.0	NA	13	0	0%
	Phenanthrene	1.65	0.757	3.23	IW-2	13	13	100%
	Pyrene	0.48	<0.10	1.73	P-7	13	8	62%
Metals (Dissolved)[f]	Arsenic	3.24	1.08	13.5	IW-2	12	12	100%
	Barium	181	89.5	351	IW-6	5	5	100%
	Beryllium	NC	<1	<1	NA	2	0	0%
	Cadmium	NC	<1	<1	NA	6	0	0%
	Chromium	0.635	<1	1.31	IW-3	6	1	17%
	Chromium VI	NC	<10	<10	NA	2	0	0%
	Copper	NC	<1	<1	NA	1	0	0%
	Lead	1.37	<1	6.6	IW-1	12	3	25%
	Mercury	NC	<0.2	<0.2	NA	5	0	0%
	Selenium	0.704	<1.0	1.02	IW-2	5	1	20%
	Silver	NC	<1	<1	NA	5	0	0%
tals tal)[g]	Arsenic	41.8	2.94	102	P-7	4	4	100%
	Barium	207	138	276	IW-2	2	2	100%
	Beryllium	NC	<1	<1	NA	2	0	0%
	Cadmium	NC	<1	<10	NA	4	0	0%
	Chromium	102	<1	405	P-7	4	3	75%

Table 5. Summary Statistics for Groundwater Contaminants of Interest
BP Terminal 22T
9930 NW St. Helens Road, Portland, Oregon

[illegible]	[illegible]	Mean	Minimum	Maximum Detected (ug/L)	Location of Maximum Detection	Number of Samples Analyzed	Number of Detections	Frequency
Me (To	Chromium VI	NC	<10	<10	NA	2	0	0%
	Copper	6.99	<20	3.97	IW-6	2	1	50%
	Lead	149	<1	586	P-7	4	3	75%
	Selenium	1.46	<1	2.42	IW-2	2	1	50%
	Silver	0.75	<1	1	IW-2	2	1	50%

Notes:

[a] Arithmetic mean calculation includes nondetected values at one-half the reporting limit
[b] Location of maximum detected concentration.
[c] Contaminant of Interest is passed to the next screening level due to being detected in greater than 5% of the samples.
[d] Volatile Organic Compounds (VOCs) per EPA Method 8260B.
[e] Polycyclic Aromatic Compounds (PAHs) per EPA Method 8270M-SIM.
[f] Dissolved metals per EPA 6000/7000 Series Method.
[g] Total metals per EPA 6000/7000 Series Method.
[h] **Bold Numerals** indicate that analyte detected at or above laboratory method reporting limit (MRL).
[i] < indicates the analyte detected below referenced laboratory MRL.
[j] NA. Because the chemical was not detected in any samples, the location is not applicable.
[k] Identified as a COI due to limited number of samples.
[l] Identified as a COI due to detections of the chemical in samples within the LPH plume.

<u>Appendix A-2</u>

ATOFINA Chemicals

ATOFINA CHEMICALS, INC.
CSM Site Summary – Appendix A-2

ATOFINA CHEMICALS, INC.

(formerly Elf Atochem)
Oregon DEQ ECSI #398

6400 NW Front Avenue
DEQ Site Mgr: Matt McClincy
Latitude: 45.5708°
Longitude: -122.74°
Township/Range/Section: 1N/1W/13

River Mile: 7.3 West bank

LWG Member ☒ Yes ☐ No

Upland Analytical Data Status: ☒ Electronic Data Available ☐ Hardcopies only

1. SUMMARY OF POTENTIAL CONTAMINANT TRANSPORT PATHWAYS TO THE RIVER

The current understanding of the transport mechanism of contaminants from the uplands portions of the ATOFINA site to the river is summarized in this section and Table 1, and supported in the following sections.

According to the Upland RI Report (ERM 2004a), the following potential contaminant transport pathways have been identified:

- Surface water discharge (overland flow from the riverbank soils)
- Groundwater migration via advection and hydrodynamic dispersion
- Stormwater discharge via outfalls.

1.1. Overland Transport

With the exception of bank soils, there is expected to be little overland transport of contaminants via soil erosion. The northern third of the property consists of open fields of brush and healthy vegetation. The southern two-thirds of the property, where chemical manufacturing activities took place, is almost entirely paved, covered with gravel, or covered with a temporary cover systems. Stormwater that does not infiltrate the ground enters the facility's four permitted outfall systems. Overland sheet runoff to the river is not an applicable issue for this facility.

1.2. Riverbank Erosion

As shown in Figure 2-3 of Appendix B (Ecological Risk Assessment Approach) of the Portland Harbor Work Plan (Integral et al. 2004), the bank in the vicinity of ATOFINA is partial river beach and steep slopes covered with bank stabilization material that includes large chunks of concrete, asphalt, and other impervious material. There is no evidence of large-scale bank erosion, although there was minor sloughing of the bank between Docks 1 and 2 during the 1996 flood. Periodic monitoring of sediment stakes placed at low-, mid-, and high-bank elevations just north of ATOFINA's northern dock shows only relatively small-scale erosion and accretion (i.e., typically less than 5 cm in extent) in riverbank elevations between July 2002 and January 2004 (Anchor 2004).

DO NOT QUOTE OR CITE.
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1.3. Groundwater

Groundwater occurs within four distinct zones at the facility (shallow, intermediate, deep, and basalt zones). The depth of shallow groundwater at the facility varies from approximately 6 to 12 feet along the western property boundary to approximately 14 to 32 feet along the eastern property boundary, along the riverbank. The general direction of groundwater flow for all zones is towards the river. The point at which each zone discharges to the river is not fully known. However, it is likely that shallow groundwater may discharge to the river near the riverbank. Upward vertical hydraulic gradients were observed in the sediment and groundwater investigations conducted in the river, in the vicinity of Docks 1 and 2.

1.4. Direct Discharge *(Overwater Activities and Stormwater/Wastewater Systems)*

Stormwater from ATOFINA is discharged through four outfalls (Figure 1). These are described in Section 9.3.

1.5. Relationship of Upland Sources to River Sediments

Investigations conducted in the upland areas and in the river indicate that upland groundwater has contributed to contamination to river groundwater. DDT in river sediments adjacent to the property is primarily present due to historic discharges from a process discharge pipe located just north of Dock 1.

The primary transport mechanism to the river is dissolved-phase constituents in groundwater.

1.6. Sediment Transport

As shown in Figure 2-3 of Appendix B (Ecological Risk Assessment Approach) of the Portland Harbor Work Plan (Integral et al. 2004), the bank in the vicinity of ATOFINA is described as river beach. Evidence of large-scale bank erosion is unknown. Periodic monitoring of sediment stakes placed at low, mid, and high bank elevations at the downstream end of the ATOFINA property near RM 7 shows only relatively small-scale erosion and accretion (i.e., typically less than 5 cm in extent) in riverbank elevations between July 2002 and January 2004 (Anchor 2004).

As described in Section 2 of the Portland Harbor Work Plan (Integral et al. 2004), the ATOFINA property is located at the downstream end of a main channel depositional zone that extends from RM 7 to 10 based on Sediment Trend Analysis® and sediment-profile image survey data. This depositional zone appears to be a function of the relatively wide cross-sectional area in this reach. The river narrows as it approaches RM 7 and the channel transitions into a more dynamic sediment transport regime. There is no site-specific sediment transport information available for the nearshore portions of the site. However, time-series bathymetry change (January 2002 to February 2004) measurements of riverbed elevation between the channel boundary and the ATOFINA shoreline show net sediment accretion on the order of 1 foot along the upstream portion of the site (around and just downstream of the farthest upstream pier) and net erosion of about 1 foot along the site downstream of the middle pier (Integral and DEA in prep).

2. CSM SITE SUMMARY REVISIONS

Date of Last Revision: September 17, 2004

3. PROJECT STATUS

[Primary Source: ECSI file and DEQ Staff Report]

Activity		Date(s)/Comments
PA/XPA	☒	Preliminary Assessment (Elf Atochem 1999); Phase II Preliminary Assessment (Elf Atochem 2000)
RI	☒	Environmental Summary Report, Lots 1 and 2 (ERM 2003); Phase II Stage 1 & 2 In-River Groundwater and Sediment Investigation Report (Integral 2003); Upland Remedial Investigation Report, Lots 3 and 4 and Tract A (ERM 2004a)
FS	☐	
Interim Action/Source Control	☒	Remedial Action Report, North Plant Area (CH2M Hill 1995); Interim Remedial Measures Implementation Report (ERM 2001 – Phase I Soil Removal IRM); Phase II Soil Interim Remedial Measure (ERM 2002); Dense Non-Aqueous Phase Liquid Remediation Pilot Study Completion Report (ERM 2004b); Hexavalent Chromium Reduction Pilot Study Completion Report (ERM 2004c)
ROD	☐	
RD/RA	☐	
NFA	☐	

DEQ Portland Harbor Site Ranking (Tier 1, 2, or 3): 1

4. SITE OWNER HISTORY

Owner/Occupant	Type of Operation	Years
ATOFINA Chemicals, Inc.	Inactive, site decommissioning	2000 – Present
Societe Nationale Elf Aquitaine (ELF)/ Elf Atochem North America	Chemical manufacturing	1989 – 2000
Pennsylvania Salt Manufacturing/Pennwalt Corp.	Chemical manufacturing	1941 – 1989

5. PROPERTY DESCRIPTION

The site is located at 6400 N.W. Front Avenue in Portland, Oregon, along the west bank of the Willamette River, at approximately RM 7.5 in the Guild's Lake Industrial Sanctuary (formerly the Northwest Portland Industrial Sanctuary). The site is zoned and designated "IH" for heavy industrial use and is bordered on the east by the Willamette River, on the south by a roofing products company, and on the north and west by Front Avenue. Excluding the river bank, the site occupies approximately 55 acres and is generally flat with surface elevations of approximately 25 to 38 feet National Geodetic Vertical Datum (NGVD) 1929 (Figure 1).

The ATOFINA Chemicals property is divided into four lots and one tract (Tract A) along the Willamette River bank [see Supplemental Figure 4 from ERM (2004a)]. Manufacturing processes took place on the southern two lots at the site (Lots 3 and 4), with the northern portion of the site (Lots 1 and 2) left relatively undeveloped [Figure 1 and Supplemental Figure 4 from ERM (2004a)]. Lots 3 and 4 were developed with buildings, paved roads, rail spur access and associated tanks and piping in support of manufacturing processes. The plant is currently in the process of decommissioning, and much of the facility infrastructure has been demolished and removed, concurrent with RI activities. ATOFINA maintains leases from the Division of State Lands (DSL) for the docks in the Willamette River.

6. CURRENT SITE USE

ATOFINA Chemical manufacturing operations ceased in 2001. Most of the infrastructure associated with the manufacturing processes has been decommissioned and removed. Demolition of remaining structures is being carried out in three phases. During Phase I, steel structures and tanks were removed. Site buildings in Lot 3 and the northern portion of Lot 4 were demolished during Phase II. Phase III demolition activities include the removal of the remainder of building structures and will take place in the summer of 2004 (ERM 2004a).

According to DEQ's ESCI database, ATOFINA still retains their RCRA large-quantity generator status. Remedial activities to address environmental contamination are ongoing.

7. SITE USE HISTORY

The facility was an inorganic chemical manufacturing facility from 1941 to 2001. It was constructed and operated by Pennsylvania Salt Manufacturing, which later became Pennwalt Corporation. Pennwalt was purchased by Societe Nationale Elf Aquitaine (ELF) in 1989, and in 1990 was combined with two other companies to form Elf Atochem North America, Inc. In 2000, Elf Atochem became ATOFINA Chemicals, Inc.

The plant began producing sodium chlorate and potassium chlorate in 1941 in the Sodium Chlorate Area [Figure 1 and Supplemental Figure 4 from ERM (2004a)]. Chlorate was produced by the electrolysis of sodium chloride solution, with sodium bichromate added as a corrosion inhibitor and to improve electrical efficiencies. Chlorate solutions were shipped from the facility by truck or barge (Dock 2). Potassium chlorate manufacturing, a process similar to the sodium chlorate operation, ended in 1978.

Sodium chloride was the primary raw material used at the site throughout its operation. It was historically delivered to the facility by ship. The salt was transferred and stored on asphalt-lined salt pads located in the southeastern corner of the site adjacent to the river [Figure 1 and Supplemental Figure 4 from ERM (2004a)].

Chlor-alkali operations started at the plant in 1946. Products included chlorine, sodium hydroxide, and hydrogen gas. Asbestos (used as a diaphragm in electrolytic cells) was historically buried in trenches on Lot 1. The trenches were excavated and the buried asbestos removed with DEQ oversight in 1992. Later, process waste asbestos was conveyed to a filter press, and the filter cake was placed in drums for offsite disposal. The plant never operated mercury chlorine cells.

Hydrochloric acid production began in 1966 in the general area where DDT was formerly manufactured. This area became known as the Acid Plant [Figure 1 and Supplemental Figure 4 from ERM (2004a)]. Chlorine and hydrogen were burned together in aboveground towers to form hydrogen chloride vapor. The vapor was absorbed in water to form hydrochloric acid. This production ceased in 2001.

The pesticide, dichlorodiphenyltrichloroethane (DDT), was manufactured at the facility from 1947 to 1954. Chemical base stocks used in the DDT manufacturing process included monochlorobenzene (MCB, or chlorobenzene), chloral, and sulfuric acid. Dry-processed DDT was placed in bags and shipped offsite by railcar.

Manufacturing process residue (MPR) from DDT manufacturing was initially discharged to floor drains, apparently connected to a storm sewer that drained to the Willamette River. From approximately 1948 until 1950, MPR was discharged to an unlined pond northeast of the manufacturing building. From 1950 until DDT manufacturing ceased in 1954, MPR was piped to a MCB recovery system for MCB recovery.

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Wastes in the recovery system were periodically drained to the MPR pond. The MCB recovery system was located immediately west of the former MPR pond. In 1951 or 1952, an 8-foot-wide by 285-foot-long trench was added to the north end of the disposal pond to increase capacity of the pond (DEQ 2003).

From 1958 to 1962, after DDT manufacturing ceased, ammonium perchlorate operations were conducted in the former DDT process building. Sodium perchlorate was converted to ammonium perchlorate by using ammonium chloride to form a solid propellant for guided missiles.

Extensive, ongoing site investigations have occurred at ATOFINA since 1994. ATOFINA submitted an application to DEQ in June 1995 to participate in the Voluntary Cleanup Program (VCP). A Remedial Investigation (ERM 2004a) was initiated in 1998 and completed in January 2004.

8. CURRENT AND HISTORIC SOURCES AND COPCS

The understanding of the current and historic potential upland and overwater sources at the site is summarized in Table 1 and shown on Figure 1. Because the site is undergoing extensive remediation and demolition at this time, several of these areas are not considered current sources of contamination. The following sections provide a brief discussion of the potential sources at the site requiring additional discussion.

8.1. Uplands

- At the initiation of DDT manufacturing in late 1947, manufacturing process residue (MPR) was discharged to floor drains connected to a storm sewer that drained into the Willamette River. In 1948, MPR was conveyed to a newly constructed, shallow, unlined pond located northeast of the manufacturing building. Starting in 1950 until DDT manufacturing operations ceased in 1954, MPR was piped to an MCB recovery system, where chlorobenzene was removed from the residue and returned to the process. Occasionally, wastes from the recovery system were placed in the pond. In about 1951 or 1952, an 8-foot wide by 285-foot long trench was constructed north of the MPR pond to increase its capacity. Elevated concentrations of MCB and DDT were found in soil in this area prior to soil removal. In response to these elevated DDT and MCB concentrations, a two-phased soil removal/source control interim remedial measure (IRM) was implemented in 2000 and 2001. Impacted soil was removed in portions of the Acid Plant Area from depths of up to 12 feet below ground surface (bgs). Some DDT- and MCB-impacted soils remain on site in the Acid Plant Area (ERM 2004a).
- In 1958, ammonium perchlorate operations were conducted in the former DDT process building. Sodium perchlorate was converted to ammonium perchlorate by using ammonium chloride. This material was sold as a solid propellant for guided missiles. The operations were shut down in approximately 1962. Some ammonium perchlorate handling took place in the No. 3 Warehouse, in the southeast corner of the Acid Plant Area (ERM 2004a).
- Sodium chlorate manufacturing started in 1941 in its current location (Figure 1). Chlorate was produced by electrolysis of a sodium chloride solution. Sodium bichromate was added to the process as a corrosion inhibitor and to improve the electrical efficiency of the process. Chlorate solutions were shipped either by truck or barge. Truck loading occurred on the southern side of the Chlorate Plant Area. Barge loading of chlorate solutions occurred at the No. 2 Dock.
- In 1994, ATOFINA excavated a trench on Lot 1 that contained DDT manufacturing process waste. Based on Section 5.1.2 of the Environmental Summary Report, Lots 1 and 2, the former DDT trench located on Lot 1 is a potential source area because very

low concentrations of DDT, DDD, and DDE (all below DEQ industrial soil cleanup levels) are present in shallow soil in a discrete area between 3 and 14 feet bgs around the perimeter of the former trench. None of the 33 confirmation samples contained constituent pesticides greater than the USEPA Region 9 Preliminary Remediation Goal (PRG) for industrial soil. The report concluded that DDT is not likely to leach to groundwater (ERM 2003). ATOFINA has a DEQ approved Soil Management Plan to ensure proper management of these soils.

- Most of the former plant areas are covered with building foundations, asphalt paving, or gravel, which limits the potential for contact between stormwater and any remaining contaminated surface soils. Significant soil removals have occurred throughout the ATOFINA site during the remediation process. DDT- and chlorobenzene-impacted soil remains in the Acid Plant Area at depths up to 22 bgs. Soil containing DDT remains along the riverbank. Some chromium-impacted soil is found in the area of the Chlorate Cell Room (ERM 2004a).
- Chemical spills have occurred on the ATOFINA site over the years (see Section 8.3 below). For example, a 200-gallon spill of sodium hydroxide occurred in the old caustic tank farm (OCTF) in February 1996. Although most of the sodium hydroxide was recovered, some of the sodium hydroxide may have spilled on soils in this area (Elf Atochem 2000).
- A sandblast pile was located on the dirt surface north of Warehouse No. 3, adjacent to the plant's eastern fence line. Spent sand was routinely sampled for TCLP metals and recycled offsite. Sample results confirmed no or very low levels of metals detected in the sand.

8.2. Overwater Activities

☐ Yes ☒ No

Shipments of sodium chloride (salt) were historically delivered by ship to either the Salt Dock or Dock 1. Sodium hydroxide, sodium chlorate solution, and chlorine were loaded onto barges for shipment from Dock 2. Inadvertent spills during transfer activities may have occurred, but it is not likely they could have been sources of sediment contamination, as these materials are highly water-soluble or immediately volatilize upon release to the atmosphere. Sources, potentially impacted media, and COIs for overland activities are summarized in Table 1.

ATOFINA maintains leases from the DSL for the docks in the Willamette River.

8.3. Spills

Known or documented spills at the ATOFINA Chemicals site were obtained either from DEQ's Emergency Response Information System (ERIS) database for the period of 1995 to 2004, from oil and chemical spills recorded from 1982 to 2003 by the U.S. Coast Guard and the National Response Center's centralized federal database [see Appendix E of the Portland Harbor Work Plan (Integral et al. 2004)], from facility-specific technical reports, or from DEQ correspondence. These spills are summarized below:

This document currently under review by US EPA and its federal, state and tribal partners, and is subject to change in whole or part.

Date	Material(s) Released	Volume Spilled (gallons)	Spill Surface (gravel, asphalt, sewer)	Action Taken (yes/no)
2/13/86	Ammonium hydroxide	1,200	Sewer	No
11/87	Sodium chlorate	Unknown	Sewer	Yes
6/8/93	50% Sodium hydroxide	225	Containment area	Yes
3/9/95	Fuel Oil	1	Dock 1/outfall area	Yes
2/23/96	Sodium hydroxide	200	Containment area	Yes

9. PHYSICAL SITE SETTING

Numerous subsurface explorations have been conducted at the ATOFINA Chemicals site since approximately 1994. Investigation techniques have included test pits, direct-push, hollow stem auger, and cable-tool borings, installation of monitoring wells, vapor extraction wells, air sparging wells, and several remediation pilot studies.

9.1. Geology

Results of the investigation indicated the following regarding site geology:

- The surficial geology at the site is characterized by fill and alluvial deposits of the Willamette River.
- The eastern portion of the site generally between Docks 1 and 2 has been filled with plant debris consisting of asphalt, concrete, pipe, soil, and fill from other sources (e.g., City of Portland). These materials occur from the surface to depths of approximately 25 feet bgs.
- The native soil profile is generally characterized by laterally discontinuous, alternating layers of dark gray-brown sand with varying amounts of silt and thinner silt layers with varying amounts of fine sand.
- Underlying the deepest silt layer, at a depth of approximately 35 feet, is a sand layer with black sands on the northern end of Lots 3 and 4 and dark gray-brown sands toward the southern end of the plant.
- Columbia River Basalt is observed below the fill and alluvium at the Site at depths of 49 to 55 feet bgs.

A cross-section layout map and cross-sections diagrams are provided as Figures 2a through 2d.

Fill materials occur from the surface to depths of approximately 25 feet bgs and consist of brown clayey silt to silty sand with occasional wood, brick, concrete, metal piping, and asphalt. Historically, fill materials were used to extend the ground surface out into the Willamette River. Fill thickness ranges from a few feet in the former DDT manufacturing area to approximately 25 feet along the riverbank. In some areas of the site, this has resulted in an extension of the ground surface into the river by up to 150 to 200 feet.

The native soil profile is generally characterized by laterally discontinuous, alternating layers of dark gray-brown sand with varying amounts of silt and thinner silt layers with varying amounts of fine sand. These sands and silts are massive to finely laminated and the contacts between the sand and silt can be gradational. In Lots 3 and 4, there are four alternating sand and silt layers; a sand layer occurs at the ground surface, underlain by a silt layer at approximately 8 feet bgs, which is underlain by additional sand and silt layers. The sand and silt layers are continuous over most of the site, with the exception of the southeast portion of the site where the silt layers become less continuous.

Underlying the deepest silt layer, at a depth of approximately 35 feet, is a sand layer with black sands on the northern end of Lots 3 and 4 and dark gray-brown sands toward the south. A deeper silt layer with some clay and fine sand is situated beneath the black and dark gray-brown sand and above the basalt bedrock.

Columbia River Basalt is inferred at a depth below the fill and alluvium throughout the area. Basalt was detected in three monitoring well borings conducted as part of the RI, at depths of 49 to 55 feet bgs. These borings are located downgradient (east) of the Acid Plant Area.

9.2. Hydrogeology

Groundwater occurs in fill materials and four distinct groundwater zones beneath the Site. In general, the depth to groundwater increases from west to east across the Site (from Front Avenue toward the Willamette River). The following tables provide a summary of the four groundwater zones and their characteristics.

Shallow Unconfined Alluvial Aquifer	
No. of Monitoring Wells	>50 (includes wells installed for monitoring of pilot studies).
Depth of Aquifer	Unconfined – ground surface to 32 feet bgs.
Depth to First Groundwater	6 to 12 feet on the west portion of the site; 14 to 32 feet on the east portion of the site (adjacent)
Saturated Thickness	~20 feet on west portion of site; ~10-15 feet adjacent to river.
Groundwater Flow Direction	East-northeast in the Acid Plant Area; east-southeast in the Chlorate Plant Area.
Hydraulic Gradient	0.0024 to 0.0069 ft/ft
Hydraulic Conductivity	5.9 ft/day to 34 ft/day (17 ft/day average)

Intermediate Confined Alluvial Aquifer	
No. of Monitoring Wells	11
Depth of Aquifer	36 to 46 feet bgs in the Acid Plant and Chlorate Plant Areas.
Saturated Thickness	5 to 10 feet
Groundwater Flow Direction	East-northeast in the Acid Plant Area; east-southeast in the Chlorate Plant Area.
Hydraulic Gradient	0.0038 to 0.0069 ft/ft
Hydraulic Conductivity	0.04 ft/day to 21 ft/day (5.8 ft/day average)

Deep Confined Alluvial Aquifer	
No. of Monitoring Wells	1
Depth of Aquifer	40 to 45 bgs
Saturated Thickness	Unknown
Groundwater Flow Direction	East-northeast
Hydraulic Gradient	Unknown
Hydraulic Conductivity	0.3 ft/day

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Basalt Bedrock Aquifer	
No. of Monitoring Wells	1
Depth of Aquifer	45 to >70 feet bgs (maximum depth explored)
Saturated Thickness	Unknown
Groundwater Flow Direction	Northeast
Hydraulic Gradient	Unknown
Hydraulic Conductivity	Unknown

On the upland portion of the site, vertical hydraulic gradients between groundwater zones are primarily downward, with occasional upward gradients observed for well pair near the Willamette River.

Recharge to shallow groundwater at the site likely occurs from precipitation that infiltrates to the west of the site.

The silts separating the groundwater zones (aquitards) vary in thickness from approximately several inches to 5 feet across the site. The distinct groundwater zones have been observed across the entire site, with the exception of the southeastern portion of the site. In that area, downgradient of the Chlorate Plant Area, the silt aquitards tend to become discontinuous and the shallow and intermediate groundwater zones tend to coalesce.

The shallow groundwater surface fluctuates seasonally, rising during periods of high rainfall and infiltration and decreasing during mid- to late-summer and low rainfall periods. Shallow groundwater in close proximity to the Willamette River will rise in direct response to large increases in Willamette River stage (e.g., during a flood). In general, these short-term perturbations do not affect shallow groundwater flow directions with the exception of short-term groundwater flow reversals in close proximity to the river.

No seeps have ever been observed on ATOFINA property by ATOFINA personnel or during the Lower Willamette Group's recently conducted seep survey of riverfront properties.

10. NATURE AND EXTENT *(Current Understanding)*

The current understanding of the nature and extent of contamination for the uplands portions of the site is summarized in this section.

10.1. Soil

10.1.1. Upland Soil Investigations ☒ Yes ☐ No

During the RI (ERM 2004a), the primary chemicals of interest in soil were DDT and its metabolites, DDD and DDE; chlorobenzene; and hexavalent chromium. Numerous soil samples were collected, including samples taken from soil borings associated with remedial measures, a vapor extraction system, and monitoring well installation as well as surface soil, soil borings, and riverbank samples.

The minimum and maximum soil detections at the Site for DDT, DDD, DDE, chlorobenzene, and total and hexavalent chromium are:

Constituent	Minimum	Maximum	Detection Limit
DDT	Non-detect	31,000 mg/kg (6-8 ft bgs)	0.0055 mg/kg
DDE	Non-detect	5,200 mg/kg (0.5-0.75 ft bgs)	0.0012 mg/kg
DDD	Non-detect	430 mg/kg (6-8 ft bgs) (620 mg/kg)*	0.0012 mg/kg
Chlorobenzene	Non-detect	15,000 mg/kg (6-8 ft bgs)	0.0011 mg/kg
Total Chromium	9.5 mg/kg	1,600 mg/kg (10-12 ft bgs)	Unknown
Hex. Chromium	Non-detect	69 mg/kg (8-10 ft bgs)	1.6 mg/kg

DDT, DDD, and DDE – Surface soil samples were collected from seven locations, primarily in the vicinity of the Acid Plant and also south of Dock 1 and adjacent to the river [Supplemental Figure 4-10 from ERM (2004a)]. All of the elevated concentrations were located in the Acid Plant Area. Up to 1,600 mg/kg of DDT was detected in surface soil samples (defined as the top 4 inches of soil) collected at Stations S-7 and S-8 in the former MPR pond. Concentrations generally decreased with depth in this area. The majority of this soil was removed during a soil removal/source control IRM. DDT was also detected as high as 16,000 mg/kg at a depth of 4.5 to 6 feet bgs in soil boring B-53 in the former MPR pond (ERM 2004a) The soil from which this sample was collected was also removed during the soil removal/source control IRM. The greatest DDT soil impacts occur in an area within 100 ft. of two sides of the former process building, the north and eastern sides. The highest DDT concentration currently existing in soil in this area is 13,000 mg/kg in the former MCB recovery system location (Boring IB-20, 3 to 4 feet bgs). Generally, DDD and DDE were detected at significantly lower concentrations (one to three orders of magnitude) than DDT throughout the Acid Plant Area. Depth to groundwater in the Acid Plant Area is approximately 20 feet bgs.

As a source control measure, a total of 4,700 tons of DDT-impacted soil was excavated and disposed off-site during the IRM. Most of the DDT-impacted soil from the MPR pond and trench was removed as part of the IRM.

In 1992, a trench identified on the northern property (Lot 1) was found to contain what appeared to be pesticide residues. A sample from the trench confirmed the presence of DDT, as well as chlorobenzene. In the fall of 1992, ATOFINA conducted a soil exploration program to assess the horizontal and vertical extent of the affected soil in the trench. The investigation determined the top of the trench was approximately 30 feet wide by 80 feet long and approximately 10 to 11 feet deep. The top of the trench was located approximately 3 feet bgs. The trench was completely excavated in 1994 (CH2M Hill 1995). Removal of DDT-impacted trench soils is discussed in Section 11.1.

Chlorobenzene (MCB) – During the RI and IRM activities, soil samples were collected from 62 borings and analyzed for VOCs. Concentrations of chlorobenzene up to 13,000 mg/kg (Boring VP-6, 7.5 to 8 feet bgs) were detected in the MCB recovery system location. The extent of highest chlorobenzene-impacted soil covers an area approximately 100 feet by 100 feet, just north of the former DDT process building in the MCB recovery system location. Soil in the vicinity of seven of the 32 borings installed as part of a vapor extraction system (VES) IRM was removed during the Phase I and II soil removal/source control IRMs. Additionally, temporary cover (asphalt paving) was installed over soil in the vicinity of three additional VES borings as part of the Phase II IRM. Chlorobenzene-impacted soils remain in a focused part of the Acid Plant Area at depths up to 16 feet bgs. Early RI activities performed in 1999 noted the presence of residual dense non-aqueous phase liquid (DNAPL) in soil in a shallow zone beneath the former MPR pond and in a thin zone downgradient of the former MPR pond and east of the Acid Plant Area. The detection of high concentrations of dissolved-phase chlorobenzene in monitoring wells in this area suggests that residual DNAPL might be a continuing source of dissolved chlorobenzene in groundwater (see Section 10.2.2). A pilot air sparge/soil vapor extraction system was installed in the fall of 2003 and has been operating since then with great success. ATOFINA plans to expand the system to full-scale during the summer of 2004.

Hexavalent Chromium – Chromium was observed in the Chlorate Plant Area soil at concentrations as high as 1,600 mg/kg in one sample up to 32 feet bgs. The highest concentrations were found near the Chlorate Cell Room and decreased to background concentrations within 250 feet of this area. Depth to groundwater in the Chlorate Plant Area is approximately 20 feet bgs.

10.1.2. Riverbank Samples

☒ Yes ☐ No

Exponent (1999) collected and analyzed seven riverbank samples from six locations (one was a duplicate sample) during the RI: three at the top of the slope, and three directly down slope, approximately 5 feet above the mean high-water elevation. All sample locations were between Dock 1 and 2 (Supplemental Figure 5). Samples were collected from between 0 and 6 inches bgs. DDT was detected in all samples at concentrations ranging from 2.3 to 120 mg/kg. The highest concentrations were detected in the northern sample location pair. Concentrations were higher in the top-of-slope sample than in the corresponding down-slope sample.

10.1.3. Summary

All ground surfaces within the former areas of the plant that were used for manufacturing are paved, covered by building foundations or have had temporary cover systems installed. Acid Plant Area soils still contain some DDT and MCB. Chlorate Plant Area soils still contain some hexavalent chromium. Because of the impervious nature of the ground surface over the areas with the most significant soil impacts, impacts to groundwater from soil-phase contamination is minimal.

10.2. Groundwater

10.2.1. Groundwater Investigations

☒ Yes ☐ No

The first groundwater investigation took place in 1994 in the Acid Plant Area to determine the presence and possible concentration of DDT and MCB in groundwater. Since that time over 60 wells have been installed at the site. Wells have been installed for both general groundwater monitoring and performance monitoring of remedial technology pilot studies. Groundwater samples have been analyzed for organochlorine pesticides, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, and other miscellaneous constituents. The most recently validated groundwater data set is from the June/July 2003 groundwater sampling event, included in Supplemental Tables 3 through 6 from ERM 2003.

10.2.2. NAPL (Historic & Current)

☒ Yes ☐ No

Early RI activities conducted in 1999 noted the presence of historic, residual MCB dense non-aqueous phase liquid (DNAPL) in soil in the shallow zone beneath the former MPR pond and in a thin zone downgradient of the pond. The observed residual DNAPL was found primarily near the shallow zone/upper silt layer interface. The presence of elevated dissolved-phase chlorobenzene concentrations in MWA-15r (Section 4.0) suggested that residual DNAPL within the Acid Plant Area downgradient of the former MPR pond might be a continuing source of dissolved chlorobenzene in groundwater.

A two-phased DNAPL investigation was initiated in early 2002 in accordance with the *Work Plan for Dense Non-Aqueous Phase Liquid Investigation, Acid Plant Area, ATOFINA Facility, Portland, Oregon* (ERM 2002). The objective of the DNAPL investigation was to assess the extent of residual chlorobenzene DNAPL in the shallow and intermediate zones and to provide a basis for evaluating remedial alternatives. The Phase I field program utilized a combination of cone penetrometer testing, membrane interface probe (MIP) screening, and direct-push (Geoprobe®) groundwater sampling to characterize subsurface conditions. The Phase II field program was conducted to further characterize the nature and extent of residual MCB DNAPL in the shallow zone immediately downgradient of the former MPR pond and to evaluate the presence and extent of any residual MCB DNAPL in the intermediate zone.

The results of the Phase I DNAPL investigation indicate that the highest concentrations of chlorobenzene in shallow-zone groundwater occur immediately north and northeast of the former MPR pond, in a 5- to 6-foot thick zone directly above the shallow silt horizon. Residual DNAPL was detected at discrete depths in the shallow zone in each of the Phase II borings. Residual DNAPL was also detected at only one intermediate-zone elevation in one boring (of seven total borings) located near the middle of the former MPR pond. The DNAPL investigations concluded that the residual MCB DNAPL is distributed in the form of ganglia or microglobules coating soil particles, rather than in a continuous, pore-filling phase. DNAPL is primarily situated in the shallow zone, and, due to its residual nature, DNAPL is not likely migrating offsite. DNAPL has not been observed in the deep or basalt zones, nor was it observed in any of the borings along the shoreline during the In-Water Investigation (Integral 2003).

10.2.3. Dissolved Contaminant Plumes ☒ Yes ☐ No

Four dissolved contaminant plumes on the site. The DDT and MCB plumes overlie each other in the Acid Plant Area, whereas the hexavalent chromium and perchlorate plumes overly each other in the Chlorate Plant Area. The greatest dissolved phase impacts to groundwater are in the shallow groundwater zone with decreasing impacts in the intermediate zone and minimal impacts in the deep zone. Plume maps are provided as Figures 3a through 3d.

Plume Characterization Status ☒ Complete ☐ Incomplete

The draft RI report has concluded that the investigations have adequately defined the nature and extent of COIs in upland groundwater and provide sufficient data for conducting the Baseline Risk Assessment and FS. The results of the upland RI are consistent with investigations conducted by ATOFINA in the nearshore area (in the vicinity of Docks 1 and 2).

Plume Extent

DDT – DEQ's Fresh Water Acute Water Quality Criterion was used to delineate the DDT plume (1.1 μg/L). The shallow groundwater zone DDT plume is approximately 75 feet wide and 150 feet long, and is localized in the Acid Plant Area. In general, the plume extends from the approximate midpoint of the former MPR trench to on the north to the northern edge of Warehouse No. 3 on the south and from the western edge of the former MPR pond on the west to the center of the paved area east of the former MPR trench on the east. The plume is limited to within the site property. DDT detections drop below the Fresh Water Acute Water Quality Criteria of 1.1 μg/L in wells along the top of the riverbank. DDT was not detected in the deep groundwater zone in the last groundwater

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sampling event.

Chlorobenzene – DEQ's Fresh Water Acute Water Quality Criterion was used to delineate the MCB plume (250 µg/L – for chlorinated benzenes). The shallow groundwater zone dissolved-phase chlorobenzene plume extends from just north of Dock 2 south to Dock 1 and from the mid-point of Warehouse No. 2 and the DDT process building to the Willamette River. The intermediate groundwater zone chlorobenzene plume is significantly smaller in extent than the shallow-zone plume. The intermediate zone chlorobenzene plume is situated between Docks 1 and 2 and is approximately 200 feet in width from north to south and extends from just west of the property fence line east to the Willamette River.

Chromium – DEQ's Fresh Water Acute Water Quality Criterion was used to delineate the chromium plume (0.016 mg/L). The shallow and intermediate hexavalent chromium plumes are situated on the south portion of Lot 4, south of Dock 1. The shallow zone hexavalent chromium plume originates in the area of the Chlorate Cell Room and extends east-southeast towards the Willamette River. The width of the shallow plume is approximated at 800 feet and extends from approximately 100 feet north of Dock 1 south to the southern site boundary. The intermediate zone plume initiates further downgradient and is situated within the footprint of the shallow zone plume.

Perchlorate – In the absence of Fresh Water Acute Water Quality Criteria, the DEQ SLV of 0.200 mg/L was used to delineate the perchlorate plumes. The primary shallow and intermediate perchlorate plumes are of similar size and orientation to the shallow and intermediate hexavalent chromium plumes, located south of Dock 1. Additional smaller plumes occur in both the shallow and intermediate zones in isolated areas just south of Dock 2.

Min/Max Detections (Current situation)

The minimum and maximum groundwater plume detections at the site for the most recent round of groundwater sampling (June and July 2003) are:

Constituent	Minimum	Maximum	Detection Limit
DDT	Non-detect	282 µg/L	0.08 µg/L
DDE	Non-detect	0.233 µg/L	0.08 µg/L
DDD	Non-detect	28.4 µg/L	0.04 µg/L
Chlorobenzene	Non-detect	185,000 µg/L	0.5 µg/L
Hex. Chrome	Non-detect	9.79 mg/L	0.001 mg/L
Perchlorate	Non-detect	290 mg/L	0.02 mg/L

Current Plume Data

The most recent complete data is for samples collected in June and July 2003. The dissolved phase DDT and MCB plumes are generally found in the Acid Plant Area, migrating in the direction of east-northeast. The hexavalent chromium and perchlorate plumes are generally located beneath the Chlorate Plant Area and migrate in the direction of east-southeast. The lateral extent of groundwater impacts is greatest in the shallow groundwater zone and decreases significantly with depth (from the intermediate to the deep and basalt groundwater zones). The nature and extent of the groundwater plumes at the Site are stable and well understood. The trends in the data have shown reductions in DDT and MCB since the prior site-wide groundwater sampling event conducted in April 2002.

Three pilot studies have been conducted at the site, which have contributed to further decreases in constituent concentrations in groundwater: the In-Situ Persulfate Pilot Study, the DNAPL Pilot Study, and the Hexavalent Chromium Reduction Pilot Study. All three pilot studies demonstrated that the tested technologies were effective at significantly reducing concentrations of their target constituents (DDT, MCB, and hexavalent chromium) in groundwater. The DNAPL Pilot Study system continues to operate, further contributing to reductions of MCB in groundwater. These pilot studies are discussed in greater detail in Section 11.2.*other concentration level], comments (e.g., qualifications, uncertainties), references.]*

Preferential Pathways

In order to determine whether the storm drain system at the Site acts as a conduit for constituents in groundwater, storm drain system manhole elevations were compared to groundwater elevations in monitoring wells nearest to the manholes. Invert elevations at 11 manholes in the Acid Plant and Chlorate Plant Areas were compared to minimum and maximum groundwater depths observed over the duration of the RI. Based on the comparison, it has been determined that storm drain system invert elevations are uniformly above groundwater in both the Acid Plant and Chlorate Plant Areas. Therefore, the storm drain system is not a potential transport pathway for COIs in groundwater. There are no other buried utilities/structures at the facility that would serve as preferential groundwater flow pathways.

Downgradient Plume Monitoring Points (min/max detections)

The following maximum and minimum concentrations are for the wells situated along the top of the riverbank, downgradient from the Acid Plant and Chlorate Plant Areas. Monitoring wells downgradient from the Acid Plant Area include: MWA-2, -3, -4, -5, and -6r in the shallow groundwater zone and MWA-8i, -9i, -10i, -14i, -16i, and -17si in the intermediate groundwater zone. Wells downgradient of the Chlorate Plant Area include: MWA-18, -19, -29, and -30 in the shallow groundwater zone and wells MWA-31i, -32i, and -34i in the intermediate groundwater zone. The following data is from the most recent groundwater sampling event (June and July 2003):

Constituent	Minimum	Maximum	Detection Limit
DDT	Non-detect	0.362 µg/L	0.08 µg/L
DDE	Non-detect	0.233 µg/L	0.08 µg/L
DDD	Non-detect	3.97 µg/L	0.04 µg/L
Chlorobenzene	Non-detect	73,200 µg/L	0.5 µg/L
Hex. Chrome	0.00236 mg/L	1.15 mg/L	0.001 mg/L
Perchlorate	Non-detect	200 mg/L	0.02 mg/L

Visual Seep Sample Data

☐ Yes ☒ No

No seeps have been observed from the ATOFINA property.

Nearshore Porewater Data

No nearshore porewater data have been collected at the site.

Groundwater Plume Temporal Trend

- A decrease in dissolved-phase DDT and MCB concentrations has been observed during the most recent groundwater sampling event (comparison of June 2003 to April 2002).

- DDT concentrations have exhibited both slight increases and significant decreases since 1999. On average, DDT concentrations in Acid Plant Area wells have decreased by one half to one order of magnitude since 1999.
- MCB concentrations in wells adjacent to the riverbank have demonstrated slight increases since 1999, whereas MCB concentrations in the vicinity of the former MPR pond and MCB recovery area have decreased significantly.
- The data sets for chromium and perchlorate in groundwater are not extensive enough to discern temporal trends in their respective concentrations.

10.2.4. Summary

The dissolved groundwater plumes at the site are relatively stable and well-documented. Residual MCB DNAPL has been observed and a focused investigation has documented the nature and extent of DNAPL in the upland subsurface. DNAPL exists in residual form and is not readily mobile. DNAPL likely contributes to the continued presence of dissolved-phase MCB in groundwater. All initial upland sources have been removed; i.e., manufacturing processes are no longer occurring, thousands of tons of soil have been removed, and aggressive interim remedial source control measures have been pilot tested and have are in the full-scale design stages. The air sparge/soil vapor extraction system will be expanded during the summer of 2004.

10.3. Surface Water

10.3.1. Surface Water Investigation ☒ Yes ☐ No

A surface water/stormwater outfall investigation was conducted and reported in the Draft RI Report.

10.3.2. General or Individual Stormwater Permit (Current or Past) ☒ Yes ☐ No

Individual NPDES Permit No. 100752 was issued to ATOFINA on January 2, 2004. The permit authorizes the discharge of stormwater from the facility through four outfalls known as Outfall Nos. 001 (WR-290), 002 (WR-362), 003 (WR-100), and 004 (WR-101). The permit requires ATOFINA to prepare and implement a stormwater pollution control plan and to characterize stormwater discharges to determine whether constituents from historical activities and 303(d) pollutants are of concern in stormwater discharge (DEQ 2003b). There are no City outfalls on ATOFINA's property. There are several abandoned outfalls that have been permanently plugged with concrete.

Permit Type	File Number	Start Date	Outfalls	Parameters/Frequency
Individual	68471	1/22/04	001, 002, 003, 004	Standard[1]/quarterly

[1] Total suspended solids, pH, copper, lead, zinc, and oil and grease.

ATOFINA also has a requirement to conduct stormwater characterization for certain legacy and 303(d) constituents. Monthly monitoring is required of all four outfalls for the following constituents for a period of one year: total dissolved solids, iron, manganese, mercury, hexavalent chromium, DDT, DDD, DDE, PAHs, PCBs, chlorobenzene, pentachlorophenol, perchlorate, and chloride. A report summarizing the one year monitoring effort is to be submitted to DEQ within 14 months after permit issuance.

Do other non-stormwater wastes discharge to the system? ☐ Yes ☒ No

No off-site stormwater or other types of wastewater enter the stormwater system.

10.3.3. Stormwater Data ☐ Yes ☐ No

Stormwater was sampled during the RI during four separate sampling events from 1999 to 2001. Stormwater samples were collected in the Acid Plant Area from a storm drain system, prior to mixing with non-contact cooling water. Total DDT and its metabolites were detected at very low concentrations, suggesting that some pesticide-containing material was present in the stormwater. However, significant reductions of these constituents were observed in stormwater after the Phase I soil removal interim remedial measure was completed (ERM 2004a).

10.3.4. Catch Basin Solids Data ☐ Yes ☒ No

10.3.5. Wastewater Permit ☒ Yes ☐ No

10.3.6. Wastewater Data ☐ Yes ☒ No

Permit Type	Permit Number	Start Date	Outfalls	Volumes	Parameters/Frequency
Individual	68471	1/29/93 (expired)	Same as above	NA	See below

Wastewater from ATOFINA was formerly discharged through four outfalls. Non-contact cooling water from the Acid Plant discharged through outfall #2. Combustion chamber cooling water from the Acid Plant was pumped to a wastewater treatment system (provided pH neutralization) and discharged through outfall #4. Cooling water from caustic evaporators was conveyed to outfall #2. Cooling water from the Chlorine Cell Room was conveyed to outfalls #3 and 4, and from the chlorine finishing process to outfall #1.

The former individual NPDES waste discharge permit required monitoring for flow, pH, conductivity, suspended solids, temperature, residual chlorine, chromium, lead, zinc, copper, and nickel. Historic average metal discharge concentrations were as follows: chromium: 0.0029 mg/L; lead: 0.0008 mg/L; zinc: 0.484 mg/L; copper: 0.0043 mg/L, and nickel: 0.0023 mg/L.

10.3.7. Summary

ATOFINA is currently conducting a 1-year stormwater runoff characterization program. Once the characterization program is completed, a summary report will be submitted to DEQ. Since the stormwater NPDES permit was issued in January 2004, there have been no exceedances of permit limits.

10.4. Sediment

10.4.1. River Sediment Data ☒ Yes ☐ No

Several river sediment investigations have occurred in the vicinity of the ATOFINA site since 1988. Sampling locations for each of these investigations are shown on Figure 1.

10.4.2. Summary

Table 2 presents a statistical summary for the analytes in surface and subsurface river sediment.

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Integral (2003) performed site-specific sediment (and groundwater) sampling in the vicinity of Docks 1 and 2 in June 2002 and February through March 2003 (Figure 1, Table 2). Analytical results indicated that MCB and DDT are present in sediments and groundwater in this area. DDT concentrations greater than 1,000 µg/kg in surface sediment were found in samples collected from the landward side of the docks, with concentrations decreasing significantly beyond the docks. The highest DDT concentrations (>100,000 µg/kg) were found in samples collected from 7 to 14.5 feet below mudline on the landward side of Dock 1. These concentrations appear to be associated with a temporary MPR discharge pipe that was active in this vicinity as long as 50 years ago.

The highest and most frequently detected chemicals have been total DDT and PAH compounds as shown in Maps 4-13 and 4-31 of the Portland Harbor Programmatic Work Plan at locations between Docks 1 and 2 (Integral et. al 2004). As shown in Table 2, total DDT in surface sediment (defined as the top 12 inches) since 1988 have ranged from 8.2 to 84,909 µg/kg (Station OSS002 in 1999; Table 2). Subsurface total DDT concentrations have ranged from 18 to 4,764,000 µg/kg (Station WB-9 in 2003; Table 2). The highest concentrations at Station WB-9 are buried 8 to 10 feet below the surface sediment.

The highest 2,4-D (93 µg/kg) and 2,4-DB (130 µg/kg) concentrations in the initial study area (ISA) were found in surface sediment samples collected at Station SD080, located downstream of ATOFINA's property near the Bayer CropScience outfall (Figure 1, Table 2). ATOFINA Chemicals never manufactured or handled these chemicals. Bayer CropScience is now Star Link Logistics Inc. DDT was handled and sold at the Star Link site. This sample location is just upstream from one private and two municipal outfalls.

PAH compounds, particularly HPAHs, have also been consistently detected offshore of ATOFINA since 1988. Benzo(b)fluoranthene was detected as high as 11,000 µg/kg in surface sediment collected in 1999 at Station OSS004, located between the two docks (Figure 1, Table 2). The subsurface sediment sample collected at OSS004 contained 9,700 µg/kg benzo(b)fluoranthene (Table 2). Total PAHs for this same station ranged from 25.5 to 71,946 µg/kg in the surface sample and 14 to 135,180 µg/kg in the subsurface sample.

The highest chlorobenzene concentrations were found in surface (up to 34,000 µg/kg) and subsurface (up to 18,000 µg/kg) sediment samples collected in 1999 at Station OSS003, slightly east of Dock 2 (Table 2, Figure 1).

11. CLEANUP HISTORY AND SOURCE CONTROL MEASURES

11.1. Soil Cleanup/Source Control

Asbestos Trenches and Pond – ATOFINA Chemicals operated asbestos diaphragm cells in the Chlorine Cell Room. These cells utilized an asbestos coated cathode and titanium anodes. The cells needed to be rebuilt periodically to improve their efficiency. Water was used to wash the asbestos diaphragm material from the cathode to two surface impoundments. A manually controlled pump was used to transfer the slurry to a third surface impoundment, located on Lot 2 of the Site. In the past, the ponds were periodically cleaned and the material was placed in trenches located on Lot 1 on the Site. This pond maintenance practice was reported to the DEQ (Elf Atochem 1999). By the late 1980s, approximately 12 trenches had been filled with asbestos-containing residue on the north end of the property. These trenches were believed to be approximately 60 ft long, 15 ft wide, and 15 ft deep. Pennwalt kept maps to identify the location of the trenches (ERM 2003).

In order to make the property useful for potential development, and to meet conditions in its renewed air permit, ATOFINA Chemicals undertook a project to decommission the ponds and to voluntarily excavate the trenches containing asbestos residues. The asbestos removal work was conducted under a work plan approved by the DEQ and under the agency's oversight. The procedure called for removal of all visible asbestos material, plus several additional inches of the surrounding soil. The project was completed in 1992 (Elf Atochem 1999). The cleanup action procedure was documented by the DEQ in a technical paper entitled *Excavation of Asbestos-Containing Material* (DEQ 1991) (ERM 2003).

DDT Trench – In 1992, a trench identified on the northern property was found to contain what appeared to be pesticide residues (ERM 2003). A sample of the trench residue was analyzed for organochlorine pesticides, semi-volatiles (by USEPA Method 8270), PCBs, and petroleum hydrocarbons. The only constituent that was detected was DDT. The sample was also analyzed for organic toxic constituents on the RCRA Characteristic Waste List. The only detected constituent was monochlorobenzene (MCB) (3.60 mg/L). Tests confirmed this trench held soils that contained residue from a DDT manufacturing process.

Because the trench was a clearly defined, discrete unit, the trench was completely excavated during the summer of 1994. Approximately 1,700 tons of soil were removed from the site and disposed at the Waste Management Subtitle C landfill in Arlington, Oregon. Post-excavation confirmation sampling showed that surrounding soils met Oregon's residential soil cleanup levels, the target cleanup level for the soil removal. After sampling was performed, the excavation was backfilled with clean fill to the ground surface (CH2M Hill 1995). Because the trench was originally located 3 feet below the ground surface, backfilling resulted in 3 feet of clean fill over the former trench location. This soil removal action was documented in the *Remedial Action Report, North Plant Area*, dated April 1995 (CH2M Hill 1995).

Brine Residue Pile and Pond – Historically, sea salt (NaCl) was used as a raw material for products manufactured at the ATOFINA Chemicals facility. The impurities calcium (Ca) and magnesium (Mg) were precipitated from the brine as calcium carbonate (CaCO3) and magnesium hydroxide (Mg[OH]2). These compounds (referred to as "brine residue" or "brine mud") were separated from the brine through clarification. Historically, the brine residue was removed from the bottom of a primary clarifier and disposed in either the brine residue pile or pond on the site (Figure 4-1 in the *Environmental Summary Report, Lots 1 and 2*; ERM 2003). In the early 1990s, the plant installed a filter press which eliminated the need to dispose of the material on the Site.

The brine pile was completely removed from the Site in February 1989 and the pond was completely removed in August 1992. A front-end loader was used to load the brine mud from the pile and pond into 10-yard truck and pups. The material in the pile was solid (no free liquids). Some free liquid was present in the pond from stormwater accumulation. The pile was initially removed so that all visible brine residue was removed, then an additional 6-inch soil cut was made to ensure removal of all brine residue materials. Over a foot of solids from the entire pond bottom and sidewall area was removed and mixed with the residue to absorb all free liquids. Visual inspection was made to ensure all brine residue material was removed. The material was transported to the Hillsboro Landfill and beneficially used as a soil amendment to the final landfill cap.

Phase I and II Soil Removal Interim Remedial Measures – During the implementation of RI field activities, evidence of DDT- and chlorobenzene-contaminated soil was observed in the Acid Plant Area. Elevated DDT and chlorobenzene concentrations were primarily identified from near ground surface to approximately 8 feet bgs. DDT and chlorobenzene were observed up to 22 feet bgs in the immediate vicinity of the former Acid Plant (boring B-61). In response to these elevated DDT and chlorobenzene concentrations, ATOFINA Chemicals implemented a two-phased IRM to mitigate potential environmental impacts.

The Phase I soil removal IRM was performed at the site between September and November 2000. A total of approximately 3,800 tons of soil was excavated and removed from the MPR pond and trench as part of the Phase I soil IRM. Additionally, a temporary surface cover was constructed in the unpaved area east of the Acid Plant Area, where unpaved soil samples had been collected.

The Phase II soil removal IRM was carried out between 5 and 16 November 2001 in the Acid Plant Area. A total of 915 tons of contaminated soil was removed during the Phase II soil IRM. The Draft RI report concluded that the Phase I and II IRMs were effective in removing significant quantities of soil containing DDT and chlorobenzene and reduced the potential for transport of constituents in shallow soils (ERM 2004a).

Soil Vapor Extraction System – The Phase I and II soil IRMs were conducted to remove DDT-contaminated soils in and around the Acid Plant Area. However, no soil removal was conducted in the former MCB Recovery Unit Area due to high concentrations of chlorobenzene in shallow soil. A soil VES was installed in December 2000 to extract chlorobenzene mass from subsurface soils, thereby reducing chlorobenzene concentrations to allow disposal of the soil as a non-hazardous waste following future excavation activities. The system was expanded incrementally over 2-1/2 years of operation and ultimately included 5 horizontal extraction wells. The system was installed, operated, and monitored in accordance with the *Work Plan for Full-Scale Vapor Extraction System* (ERM 2000) and subsequent work plan addenda approved by DEQ.

Stormwater System Improvements – At the completion of the Phase I and II Soil Removal IRM's mentioned above, asphalt paving was placed over the area to direct stormwater directly to surface drains. A fill area on the eastern boundary of the Acid Plant area was also provided with a temporary impermeable cover to divert storm runoff directly to surface drains.

11.2. Groundwater Cleanup/Source Control

Cleanup and source control actions to date include the following:

***In-situ* Persulfate Pilot Study** – A pilot study was conducted in the vicinity of the former DDT manufacturing area, where MCB concentrations in groundwater have historically been the highest observed at the site. The study was initiated to determine the feasibility of persulfate injections on reduction of MCB mass in groundwater. During the pilot study, residual DNAPL was observed in one of the pilot study monitoring wells. Attempts were made to remove DNAPL, but none was recoverable. Although the pilot study was suspended because of the residual DNAPL and the DNAPL investigation was initiated, early results demonstrated that persulfate was a very effective in-situ technology for destruction of MCB and DDT in groundwater at the facility. An expansion of the initial pilot study as an IRM/source control measure is planned for 2004.

DNAPL Remediation Pilot Study – A pilot study was conducted in the location of the highest MCB concentrations observed during the DNAPL investigation. The pilot study was conducted to determine the feasibility and effectiveness of coupling air sparging with vapor extraction for remediation of DNAPL and dissolved-phase MCB. The pilot study was operated for approximately 5 months and resulted in the reduction of average MCB concentrations of about 60% (for the 10 wells sampled as part of the pilot study). The air sparge system was only operated for 2 months. Both the pilot test air sparging and soil vapor extraction systems are currently operating. Based on the success of the pilot study, a full-scale air sparging/vapor extraction IRM/source control measure is planned for implementation in 2004.

Hexavalent Chromium Reduction Pilot Study – A third pilot study was conducted at the site in the location of the highest chromium concentrations, downgradient of the Chlorate Cell Room. The study involved the injection of calcium polysulfide to reduce chromium from its hexavalent state to its trivalent state. Results of the study indicate that chromium concentrations decreased by an average of 95% approximately 15 weeks after the injection of calcium polysulfide. Results indicate that the study was very successful and that expansion of the technology into a full-scale IRM/source control measure is planned for implementation in 2004.

Bench Scale Perchlorate Pilot Study – A bench-scale study is currently being conducted to investigate the potential for bioremediation of perchlorate using native microbial populations and a variety of electron donors. The bench-scale study is nearing completion.

11.3. Other

The site is currently undergoing demolition of nearly all former plant structures. The front office, docks, perimeter fence, and some concrete slabs will be left in place as the RI/FS process proceeds.

11.4. Potential for Recontamination from Upland Sources

The majority of the DDT in the sediments off-shore of the facility has been in place for over 50 years. The chlorobenzene present in the upland groundwater presents a source control issue because it is a cosolvent for DDT. The chlorobenzene in the groundwater potentially could dissolve DDT. The perchlorate and chromium plumes may be a potential continuing source via the groundwater to surface water pathway. ATOFINA is moving aggressively with significant success on programs to address chlorobenzene, DDT, chromium, and perchlorate in groundwater.

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Figures:

Tables:

Supplemental Figures:

Supplemental Tables:

FIGURES

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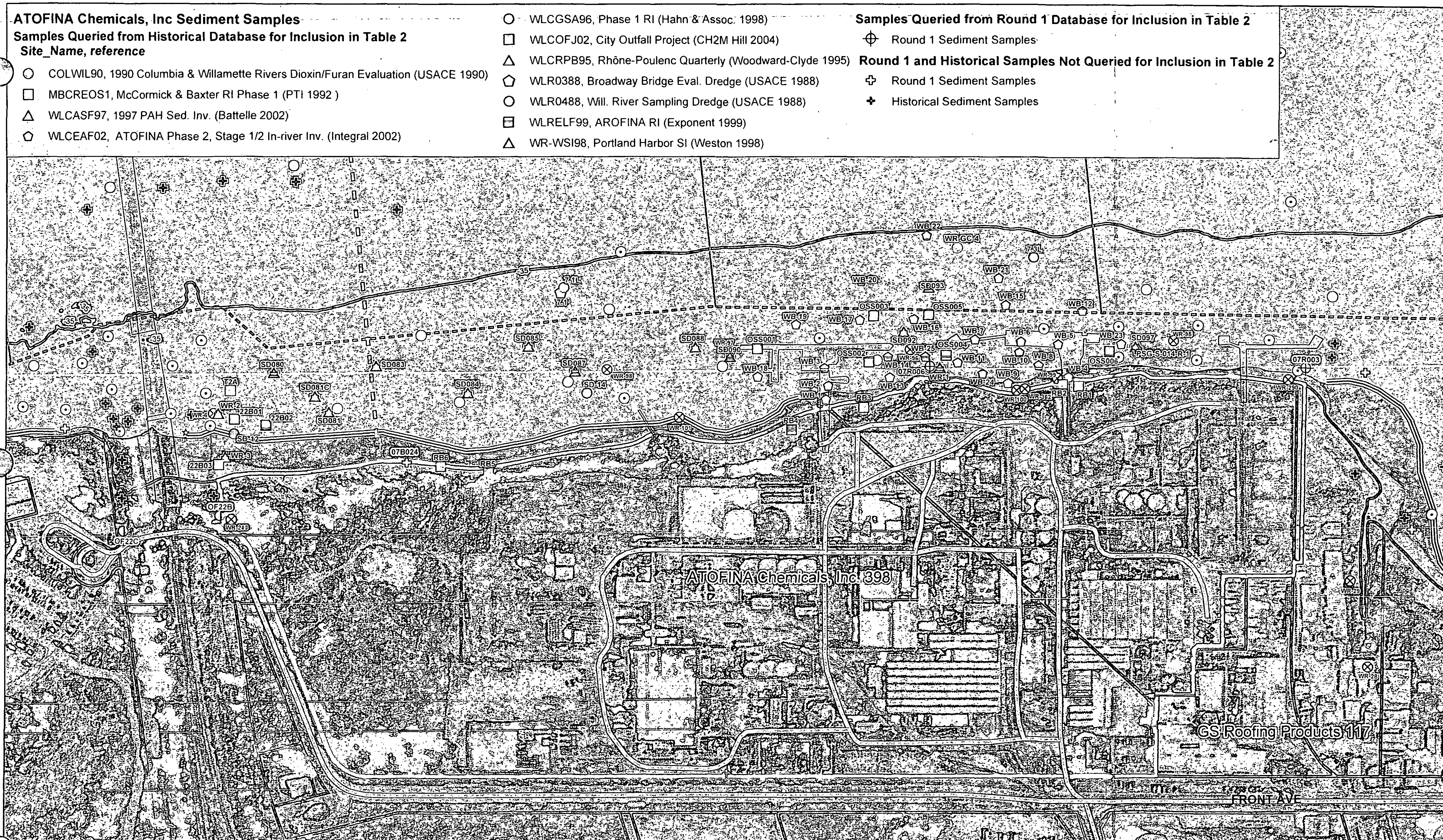

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Areal Photo Date: October 2001.
Base Map features from Portland Metro's RLIS.
The City of Portland Outfall mapping information is based on available records; no warranty, expressed or implied, is provided as to the completeness or accuracy of the information. Current layer updated June 2004.

Outfalls (private)
City Outfalls
City Outfalls (Abandoned)
Seep Photo Location (Not location of actual Seep)
River Miles
Navigation Channel
-35ft. Contour (NAVD 88)
Docks & In-water Structures
Selected ECSI Site Property Boundary

Human Use Areas
Dockside Worker
Recreational Beach Use
Transient

LWG Round 2 Proposed Sediment Samples
Surface Sample Only
Core & Surface Sample

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0 150 300 600 Feet

Figure 1
Portland Harbor RI/FS
Conceptual Site Model
ATOFINS Chemicals, Inc.
ECSI 398

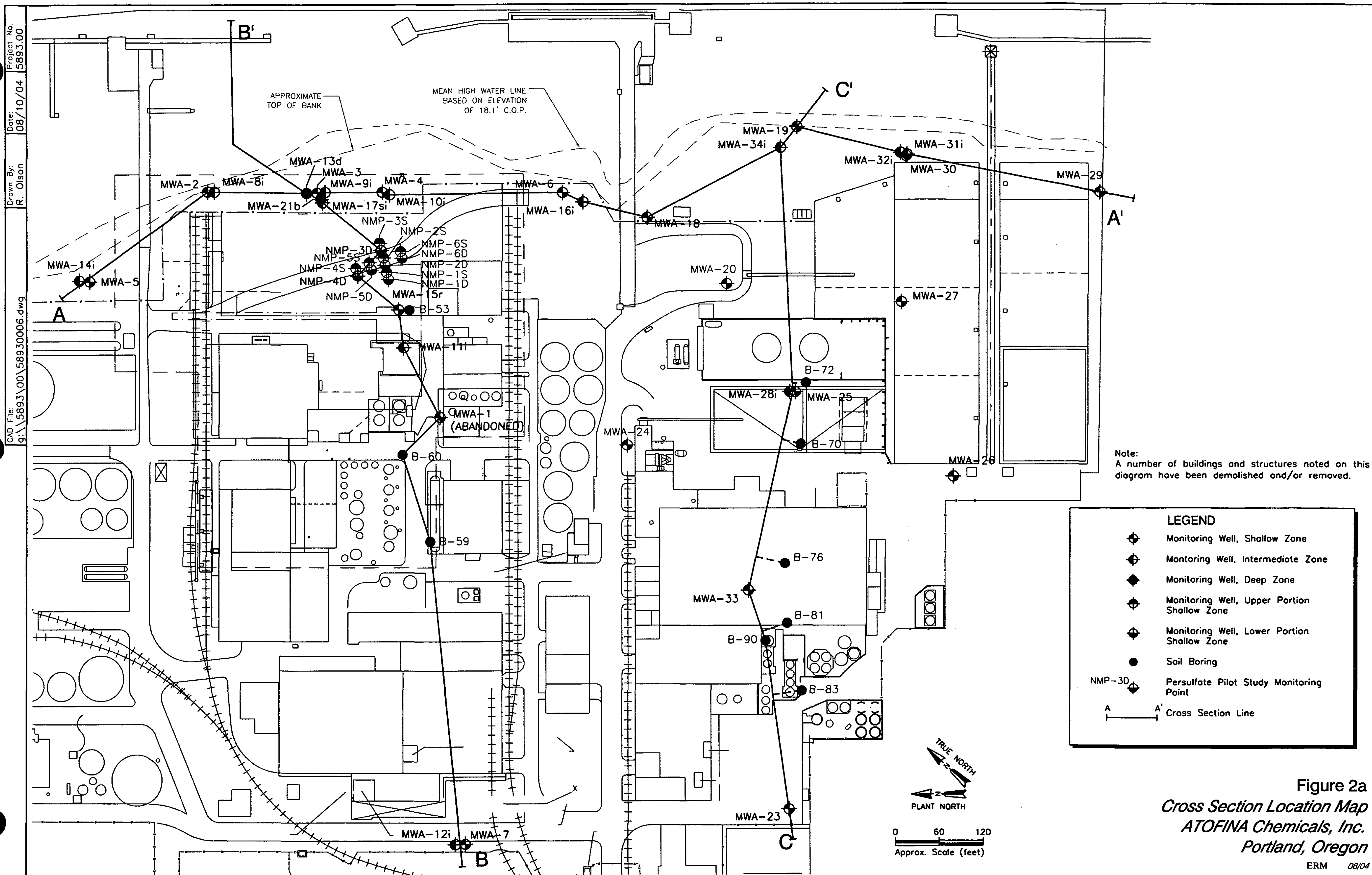

Figure 2a
Cross Section Location Map
ATOFINA Chemicals, Inc.
Portland, Oregon
ERM 08/04

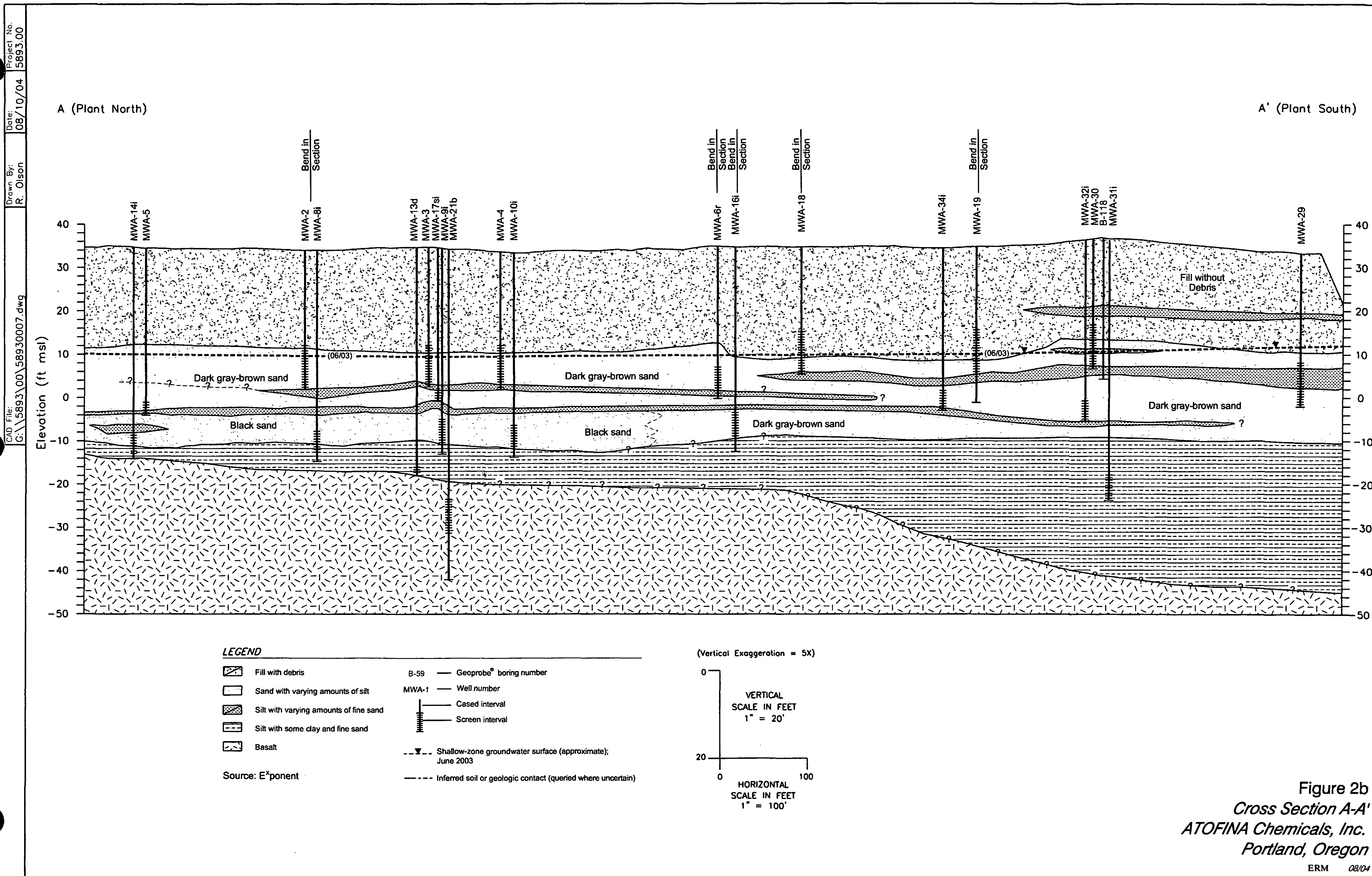

Figure 2b
Cross Section A-A'
ATOFINA Chemicals, Inc.
Portland, Oregon

ERM *08/04*

Project No. 5893.00
Date: 08/10/04
Drawn By: R. Olson
CAD File: g:\\5893\00\58930008.dwg

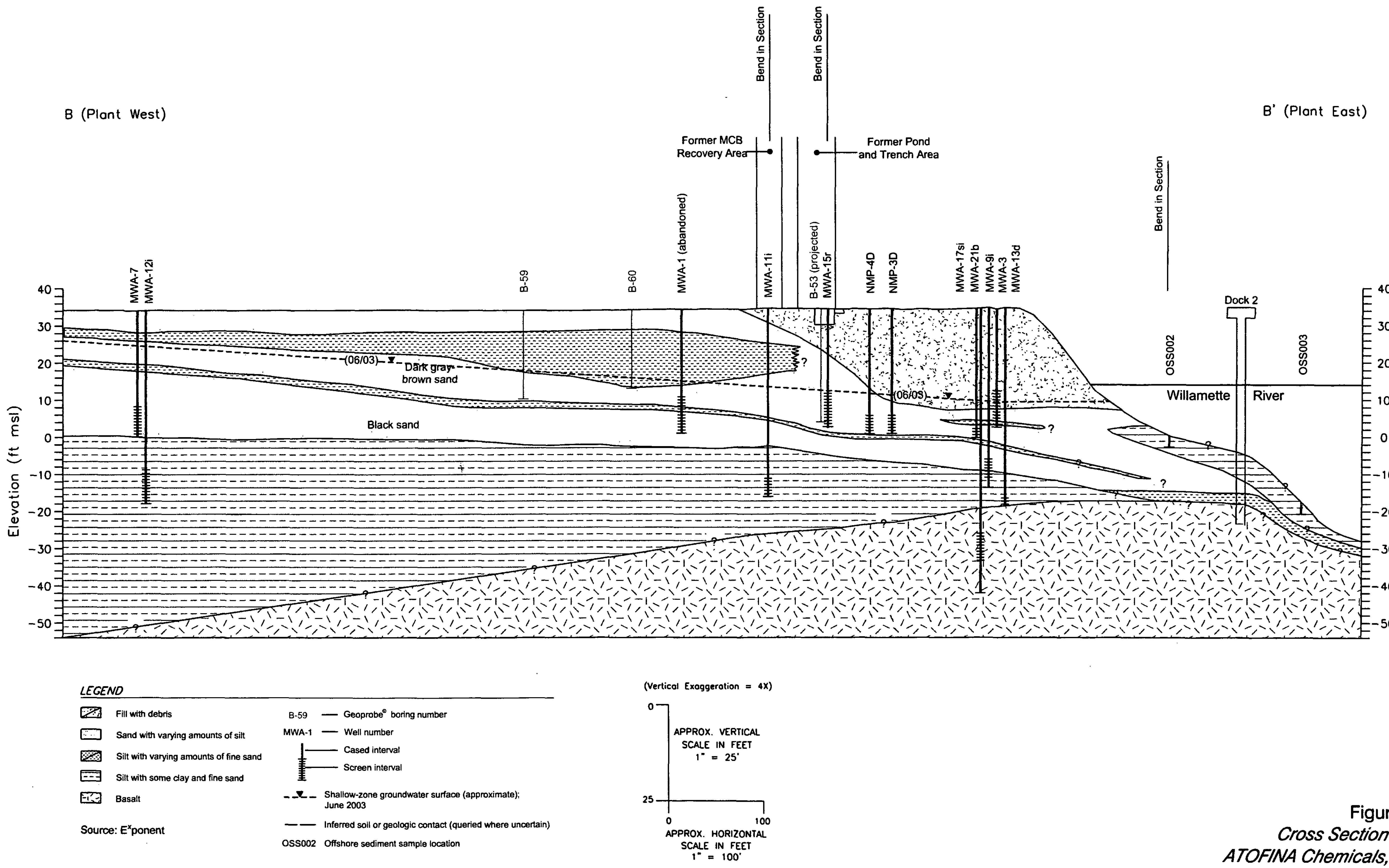

Figure 2c
Cross Section B-B'
ATOFINA Chemicals, Inc.
Portland, Oregon
ERM 08/04

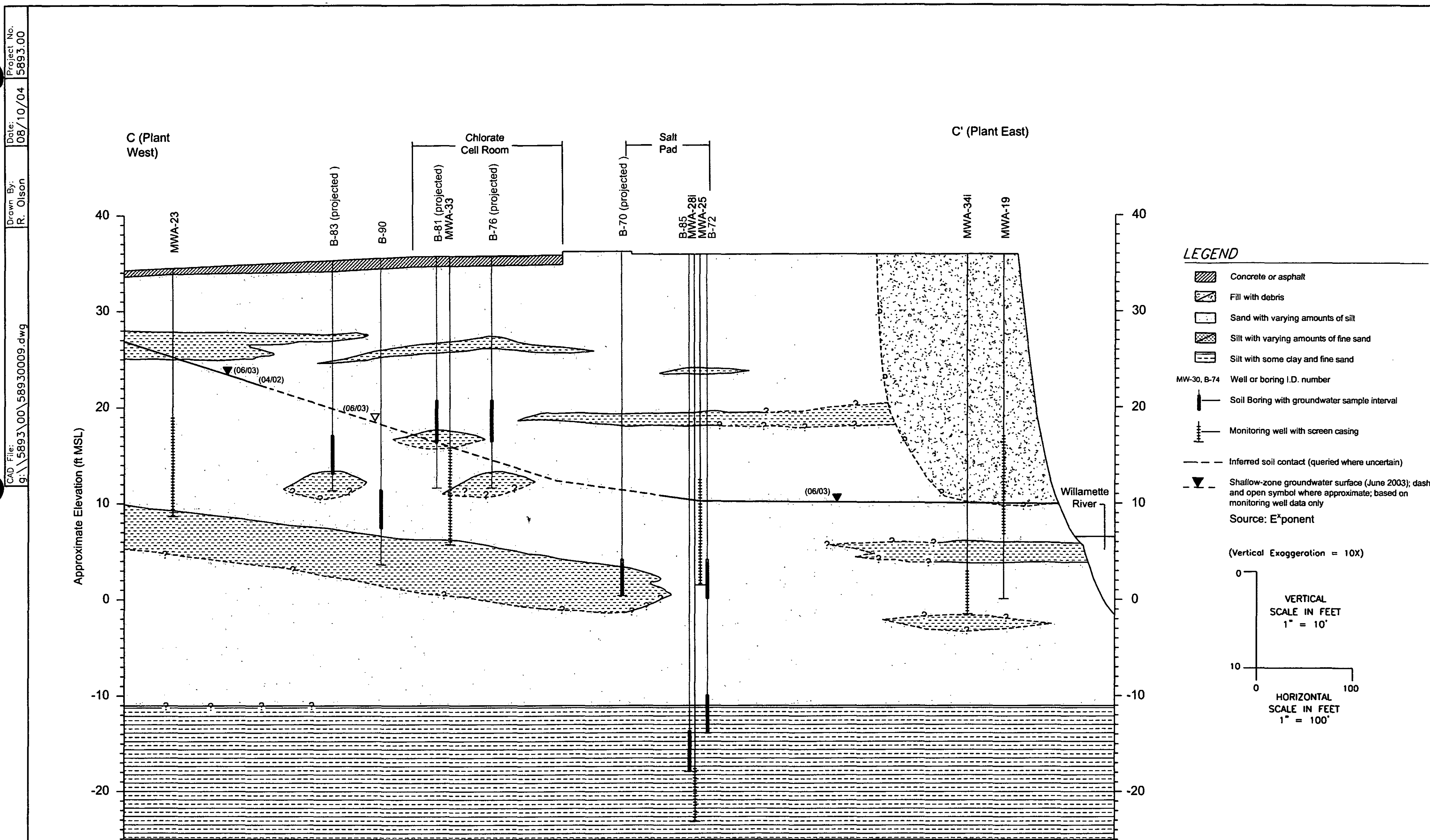

Figure 2d

Cross Section C-C'

ATOFINA Chemicals, Inc.

Portland, Oregon

ERM 08/04

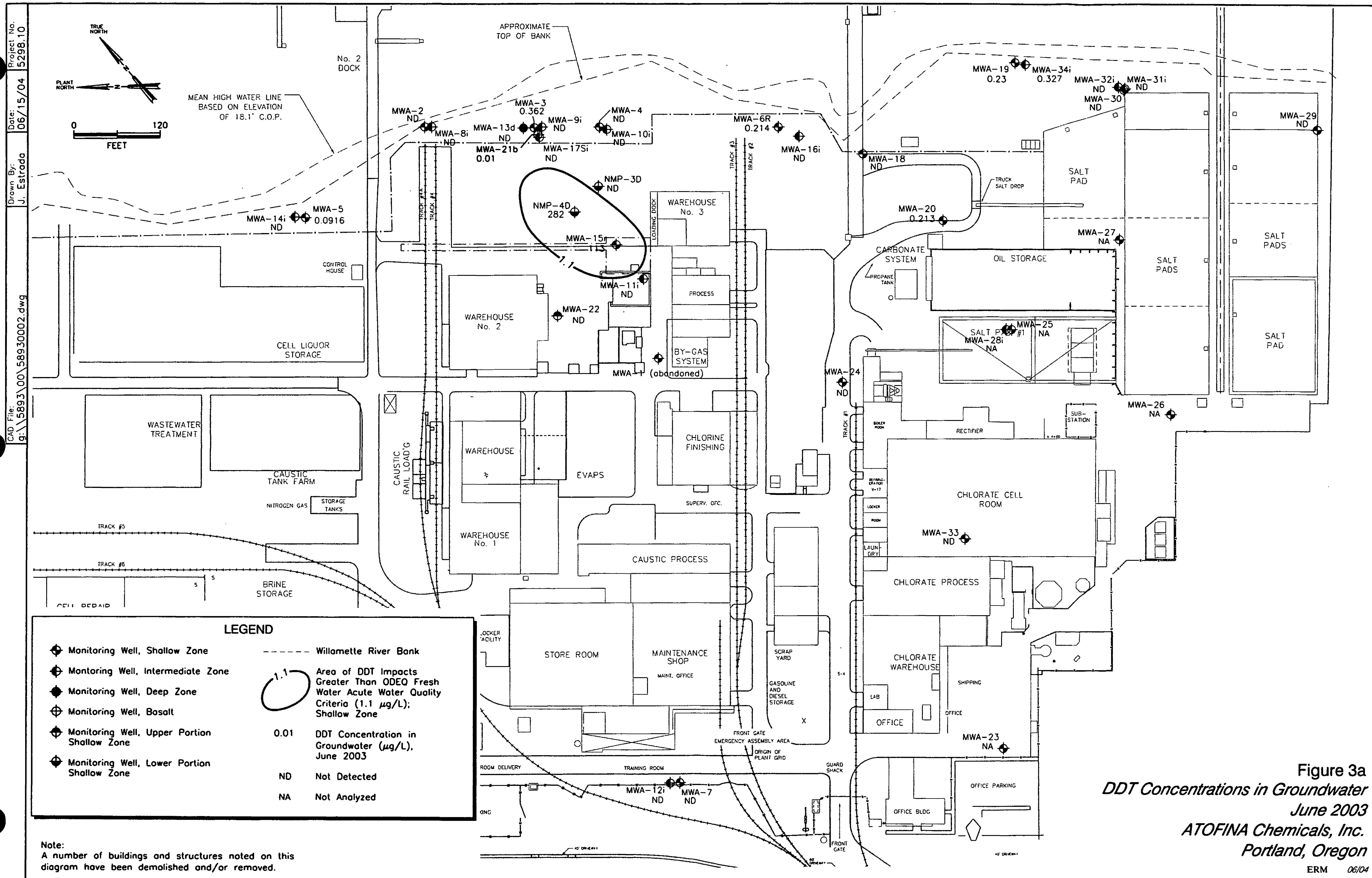

Figure 3a
DDT Concentrations in Groundwater
June 2003
ATOFINA Chemicals, Inc.
Portland, Oregon
ERM 06/04

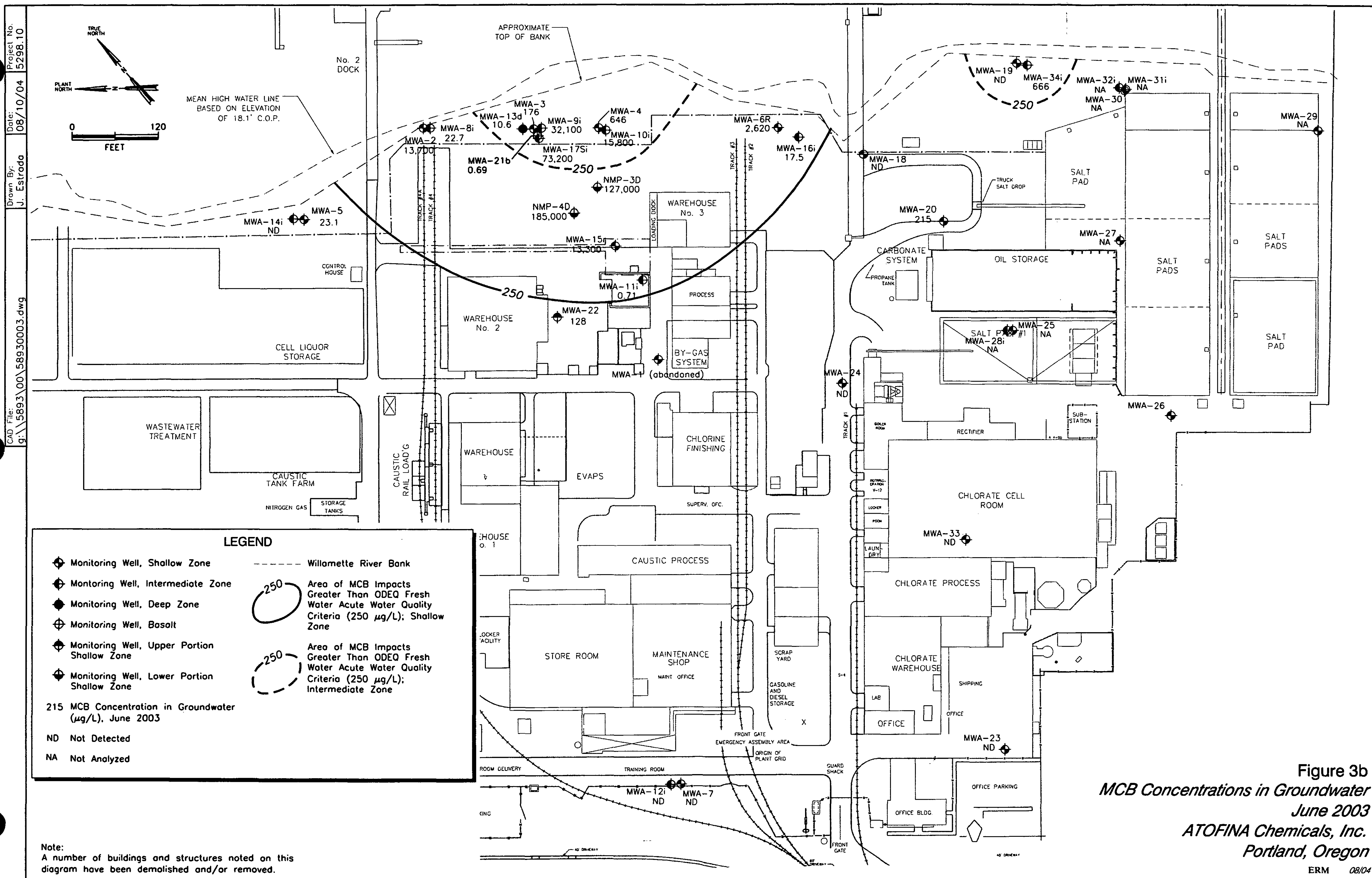

Figure 3b
MCB Concentrations in Groundwater
June 2003
ATOFINA Chemicals, Inc.
Portland, Oregon

ERM 08/04

Note:
A number of buildings and structures noted on this diagram have been demolished and/or removed.

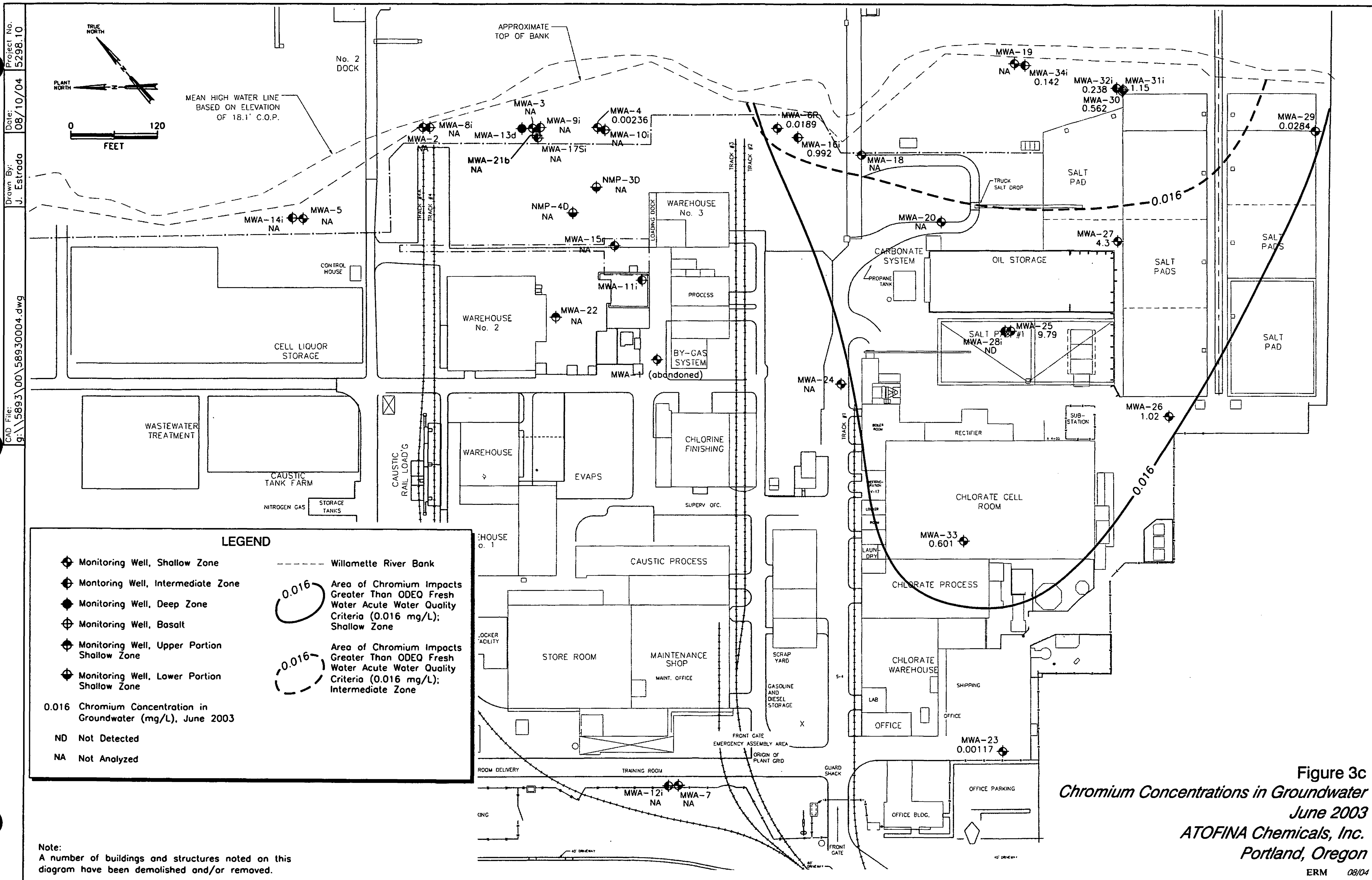

Figure 3c
Chromium Concentrations in Groundwater
June 2003
ATOFINA Chemicals, Inc.
Portland, Oregon
ERM 08/04

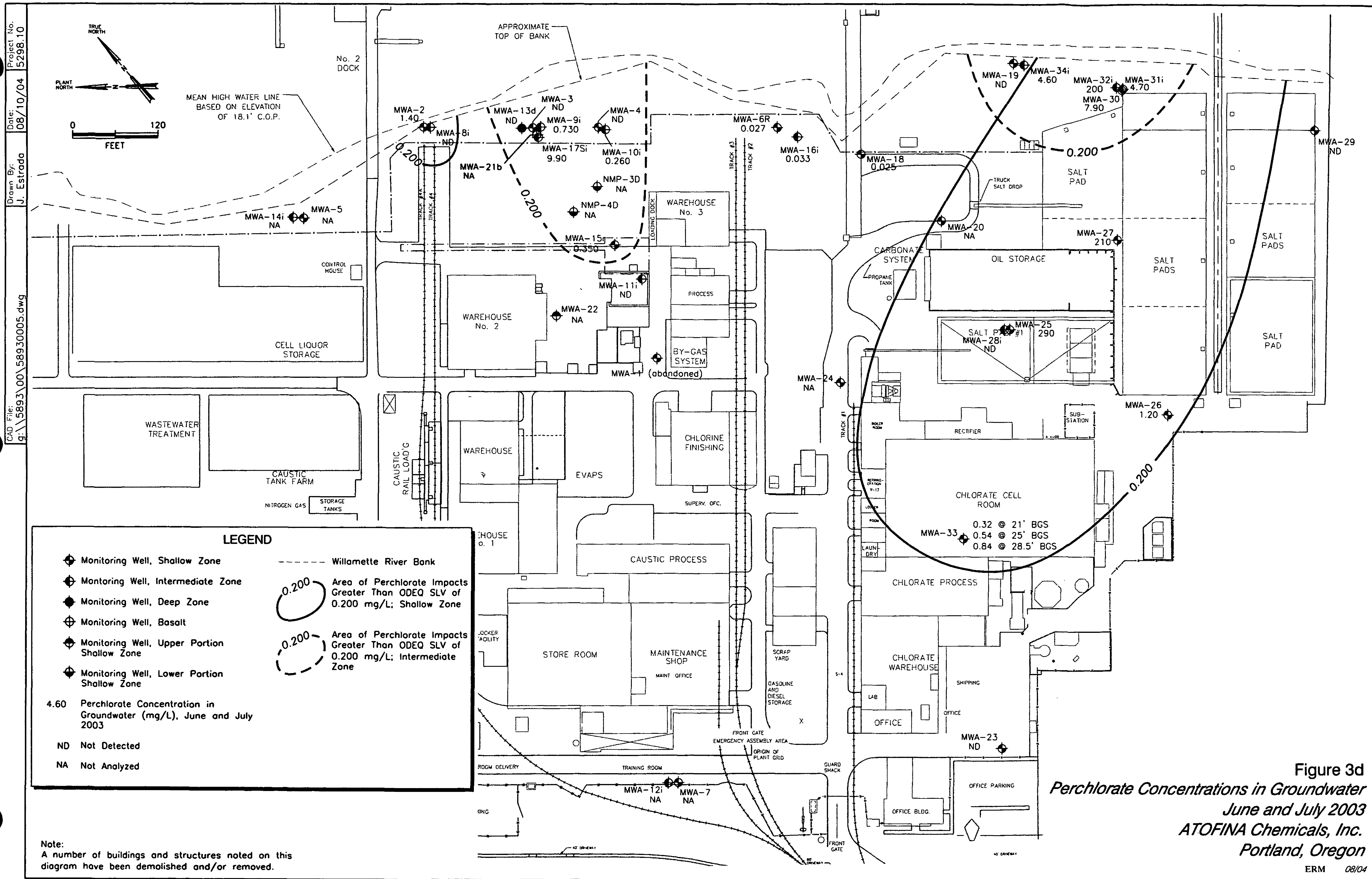

Figure 3d
Perchlorate Concentrations in Groundwater
June and July 2003
ATOFINA Chemicals, Inc.
Portland, Oregon

ERM *08/04*

TABLES

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ATOFINA Chemicals, Inc. #398

Table 1. Potential Sources and Transport Pathways Assessment

Last Updated: September 17, 2004

	Media Impacted					COIs																		Potential Complete Pathway				
						TPH			VOCs																			
Description of Potential Source	Surface Soil	Subsurface Soil	Groundwater	Catch Basin Solids	River Sediment	Gasoline-Range	Diesel - Range	Heavier - Range	Petroleum-Related (e.g. BTEX)	VOCs	Chlorinated VOCs	SVOCs	PAHs	Phthalates	Phenolics	Metals	PCBs	Herbicides and Pesticides	Dioxins/Furans	Butyltins	Ammonia	Perchlorate	(Others - List)	Overland Transport	Groundwater	Direct Discharge - Overwater	Direct Discharge - Storm/Wastewater	Riverbank Erosion
Upland Areas																												
Former unlined MPR pond and trench	✓	✓	✓								✓							✓							✓			
Historic discharge through pipe					✓						✓							✓									✓	
Unpaved areas with contaminated soils	✓	✓														✓		✓						?			?	?
Historic spill areas	✓	✓	✓													✓					✓							
Stormwater discharge outfalls				✓														✓									?	
Contaminated groundwater plume			✓								✓	✓				✓		✓				✓			✓			
Overwater Areas																												
B																												
Other Areas/Other Issues																												

Notes:

[1] All information provided in this table is referenced in the site summaries. If information is not available or inconclusive, a ? may be used, as appropriate. No new information is provided in this table.

✓ = Source, COI are present or current or historic pathway is determined to be complete or potentially complete.

? = There is not enough information to determine if source or COI is present or if pathway is complete.

Blank = Source, COI and historic and current pathways have been investigated and shown to be not present or incomplete.

UST Underground storage tank
AST Above-ground storage tank
TPH Total petroleum hydrocarbons
VOCs Volatile organic compounds
SVOCs Semivolatile organic compounds
PAHs Polycyclic aromatic hydrocarbons
BTEX Benzene, toluene, ethylbenzene, and xylenes
PCBs Polychorinated biphenols

Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or			Number	Number	%	Detected Concentrations					Detected and Nondetected Concentrations				
Subsurface	Analyte	Units	of Samples	Detected	Detected	Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
Surface	Aroclor 1016	(ug/kg)	6	0							380 U	2000 U	955	980 U	1000 U
Surface	Aroclor 1242	(ug/kg)	6	0							380 U	2000 U	955	980 U	1000 U
Surface	Aroclor 1248	(ug/kg)	6	0							380 U	2000 U	955	980 U	1000 U
Surface	Aroclor 1254	(ug/kg)	6	0							380 U	2000 U	955	980 U	1000 U
Surface	Aroclor 1260	(ug/kg)	6	0							380 U	2000 U	955	980 U	1000 U
Surface	Aroclor 1221	(ug/kg)	6	0							750 U	4000 U	1920	2000 U	2000 U
Surface	Aroclor 1232	(ug/kg)	6	0							380 U	2000 U	955	980 U	1000 U
Surface	Polychlorinated biphenyl	(ug/kg)	9	0							4 UJ	4000 UA	1280	760 UA	2000 UA
Surface	Butyltin ion	(ug/kg)	1	0							5.7 U	5.7 U	5.7	5.7 U	5.7 U
Surface	Dibutyltin ion	(ug/kg)	1	0							5.7 U	5.7 U	5.7	5.7 U	5.7 U
Surface	Dibutyltin ion	(ug/l)	1	0							0.06 U	0.06 U	0.06	0.06 U	0.06 U
Surface	Tributyltin ion	(ug/kg)	1	1	100.0	44	44	44	44	44	44	44	44	44	44
Surface	Tributyltin ion	(ug/l)	1	0							0.02 U	0.02 U	0.02	0.02 U	0.02 U
Surface	Tetrabutyltin	(ug/kg)	1	0							5.7 U	5.7 U	5.7	5.7 U	5.7 U
Surface	Tetrabutyltin	(ug/l)	1	0							0.02 U	0.02 U	0.02	0.02 U	0.02 U
Surface	Total solids	(%)	4	4	100.0	26.5	73.8	59.7	65	73.5	26.5	73.8	59.7	65	73.5
Surface	Total organic carbon	(%)	35	35	100.0	0.06	4.51	1.2	1.3	2.3	0.06	4.51	1.2	1.3	2.3
Surface	Moisture	(%)	4	4	100.0	39	220	87.8	41	51	39	220	87.8	41	51
Surface	pH	(pH units)	4	4	100.0	6.4	7	6.6	6.4	6.6	6.4	7	6.6	6.4	6.6
Surface	Specific Gravity	(Std.units)	4	4	100.0	2.49	2.75	2.67	2.71	2.74	2.49	2.75	2.67	2.71	2.74
Surface	2,3,7,8-Tetrachlorodibenzo-p-dioxin	(ng/kg)	5	1	20.0	3.4	3.4	3.4	3.4	3.4	0.24 U	3.4	1.47	0.41 U	3 U
Surface	Tetrachlorodibenzo-p-dioxin	(ng/kg)	4	3	75.0	11	66	30.3	14	14	0.93 U	66	23	11	14
Surface	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	(ng/kg)	5	0							0.44 U	3 U	1.28	0.63 U	1.9 U
Surface	Pentachlorodibenzo-p-dioxin	(ng/kg)	4	0							0.85 U	3.6 U	1.69	1 U	1.3 U
Surface	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	(ng/kg)	5	0							0.4 U	4 U	1.69	0.58 U	3 U
Surface	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	(ng/kg)	5	2	40.0	2	15	8.5	2	2	1.3 U	15	4.48	2 U	2.1 U
Surface	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	(ng/kg)	5	2	40.0	1 J	9.4	5.2	1 J	1 J	1 J	9.4	2.82	1.2 U	1.4 U
Surface	Hexachlorodibenzo-p-dioxin	(ng/kg)	4	4	100.0	5	85	25.1	5.2	5.2	5	85	25.1	5.2	5.2
Surface	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	(ng/kg)	5	5	100.0	26	380	104	40	40	26	380	104	40	40
Surface	Heptachlorodibenzo-p-dioxin	(ng/kg)	4	4	100.0	83	740	250	87	88	83	740	250	87	88
Surface	Octachlorodibenzo-p-dioxin	(ng/kg)	5	5	100.0	250	3600	970	330	350	250	3600	970	330	350
Surface	2,3,7,8-Tetrachlorodibenzofuran	(ng/kg)	5	5	100.0	1.6	20	10.7	8.5	19	1.6	20	10.7	8.5	19
Surface	Tetrachlorodibenzofuran	(ng/kg)	4	4	100.0	6.1	91	46.8	20	70	6.1	91	46.8	20	70
Surface	1,2,3,7,8-Pentachlorodibenzofuran	(ng/kg)	5	4	80.0	5	86	34.3	6.2	40	0.97 U	86	27.6	6.2	40
Surface	2,3,4,7,8-Pentachlorodibenzofuran	(ng/kg)	5	2	40.0	10	22	16	10	10	0.65 U	22	7.75	3.8 U	10
Surface	Pentachlorodibenzofuran	(ng/kg)	4	4	100.0	6.2	180	64.1	9.2	61	6.2	180	64.1	9.2	61
Surface	1,2,3,4,7,8-Hexachlorodibenzofuran	(ng/kg)	5	4	80.0	6.7	140	51.9	11	50	1.2 U	140	41.8	11	50
Surface	1,2,3,6,7,8-Hexachlorodibenzofuran	(ng/kg)	5	2	40.0	10	65	37.5	10	10	1.9 U	65	17.8	9.6 U	10
Surface	1,2,3,7,8,9-Hexachlorodibenzofuran	(ng/kg)	5	0							0.18 U	3.5 U	1.48	0.41 U	3 U
Surface	2,3,4,6,7,8-Hexachlorodibenzofuran	(ng/kg)	5	2	40.0	7 J	13	10	7 J	7 J	0.41 U	13	4.9	3.3 U	7 J
Surface	Hexachlorodibenzofuran	(ng/kg)	4	4	100.0	5.2	260	88.7	6.7	83	5.2	260	88.7	6.7	83
Surface	1,2,3,4,6,7,8-Heptachlorodibenzofuran	(ng/kg)	5	4	80.0	6.3	90	31.2	8.3	20 J	6.3	90	40.1	20 J	76 U
Surface	1,2,3,4,7,8,9-Heptachlorodibenzofuran	(ng/kg)	5	3	60.0	5 J	33	14.7	6	6	1.1 U	33	9.34	5 J	6
Surface	Heptachlorodibenzofuran	(ng/kg)	4	4	100.0	12	160	88.8	33	150	12	160	88.8	33	150
Surface	Octachlorodibenzofuran	(ng/kg)	5	5	100.0	15	330	119	90 J	120	15	330	119	90 J	120
Surface	Gravel	(%)	29	29	100.0		13.3	1.89	0.29	6.47	0	13.3	1.89	0.29	6.47
Surface	Sand	(%)	28	28	100.0	16.8	99.7	55.7	46	99	16.8	99.7	55.7	46	99
Surface	Very coarse sand	(%)	1	1	100.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Surface	Coarse sand	(%)	1	1	100.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Surface	Medium sand	(%)	1	1	100.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Surface	Fine sand	(%)	1	1	100.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8

Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
Surface	Very fine sand	(%)	1	1	100.0	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Surface	Fines	(%)	28	28	100.0	0.083	83.2	42.4	40.7	76.1	0.083	83.2	42.4	40.7	76.1
Surface	Silt	(%)	28	28	100.0	0.02	70	36.6	35.9	67.93	0.02	70	36.6	35.9	67.93
Surface	Coarse silt	(%)	1	1	100.0	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
Surface	Medium silt	(%)	1	1	100.0	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4
Surface	Fine silt	(%)	1	1	100.0	16	16	16	16	16	16	16	16	16	16
Surface	Very fine silt	(%)	1	1	100.0	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7
Surface	Clay	(%)	28	28	100.0	0.033	13.2	5.78	4.8	11.51	0.033	13.2	5.78	4.8	11.51
Surface	8-9 Phi clay	(%)	1	1	100.0	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Surface	9-10 Phi clay	(%)	1	1	100.0	4	4	4	4	4	4	4	4	4	4
Surface	>10 Phi clay	(%)	1	1	100.0	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4
Surface	Dalapon	(ug/kg)	10	0							25 U	1000 U	188	31 U	500 U
Surface	Dicamba	(ug/kg)	10	0							2.6 U	100 U	18.9	3.3 U	50 U
Surface	MCPA	(ug/kg)	10	0							130 U	50000 U	8590	170 U	25000 U
Surface	Dichloroprop	(ug/kg)	10	0							2.6 U	250 U	48.6	15 U	120 U
Surface	2,4-D	(ug/kg)	10	3	30.0	21	93	46	24	24	2.6 U	250 U	56.7	24	120 U
Surface	Silvex	(ug/kg)	10	0							2.6 U	50 U	10.4	3.3 U	25 U
Surface	2,4,5-T	(ug/kg)	10	0							2.6 U	50 U	10.4	3.3 U	25 U
Surface	2,4-DB	(ug/kg)	10	3	30.0	13	130	55.3	23	23	3.9 U	1000 U	188	23	500 U
Surface	Dinoseb	(ug/kg)	10	0							3.9 UJ	250 U	44.8	5 UJ	120 U
Surface	MCPP	(ug/kg)	10	0							130 U	50000 U	8590	170 U	25000 U
Surface	Aluminum	(mg/kg)	16	16	100.0	14000	42700	33500	38900	42700	14000	42700	33500	38900	42700
Surface	Aluminum	(mg/l)	1	1	100.0	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
Surface	Antimony	(mg/kg)	14	3	21.4	6.2 J	12 J	8.57	7.5 J	7.5 J	5 UJ	12 J	6.19	5 UJ	8 UJ
Surface	Antimony	(mg/l)	1	0							0.05 U	0.05 U	0.05	0.05 U	0.05 U
Surface	Arsenic	(mg/kg)	20	7	35.0	2.2 J	9.7 J	4.83	4.2 J	5.8 J	2.2 J	10 U	5.64	5 U	9.7 J
Surface	Arsenic	(mg/l)	1	1	100.0	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Surface	Cadmium	(mg/kg)	20	16	80.0	0.081	1.7	0.423	0.4	0.6	0.081	1.7	0.454	0.4	0.88 U
Surface	Cadmium	(mg/l)	1	0							0.002 U	0.002 U	0.002	0.002 U	0.002 U
Surface	Chromium	(mg/kg)	20	20	100.0	9.5 J	50.6	30	29.6	44.6	9.5 J	50.6	30	29.6	44.6
Surface	Chromium	(mg/l)	1	0							0.005 U	0.005 U	0.005	0.005 U	0.005 U
Surface	Copper	(mg/kg)	16	16	100.0	12	57.5	38.9	39.9	53.4	12	57.5	38.9	39.9	53.4
Surface	Copper	(mg/l)	1	1	100.0	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Surface	Lead	(mg/kg)	23	23	100.0	7.3	186	28.3	20.1	27	7.3	186	28.3	20.1	27
Surface	Lead	(mg/l)	1	1	100.0	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Surface	Manganese	(mg/kg)	16	16	100.0	335	693	537	560	683	335	693	537	560	683
Surface	Manganese	(mg/l)	1	1	100.0	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56
Surface	Mercury	(mg/kg)	20	17	85.0	0.01	0.36	0.0847	0.07	0.12	0.01	0.36	0.087	0.08	0.12
Surface	Mercury	(mg/l)	1	0							0.0001 U	0.0001 U	0.0001	0.0001 U	0.0001 U
Surface	Nickel	(mg/kg)	16	16	100.0	11	38.5	27.6	28.2	34	11	38.5	27.6	28.2	34
Surface	Nickel	(mg/l)	1	0							0.01 U	0.01 U	0.01	0.01 U	0.01 U
Surface	Selenium	(mg/kg)	16	13	81.3	10	16	12.7	13	15	0.36 UJ	16	10.4	12	15
Surface	Selenium	(mg/l)	1	0							0.001 U	0.001 U	0.001	0.001 U	0.001 U
Surface	Silver	(mg/kg)	16	13	81.3	0.9	1.6	1.18	1.2	1.4	0.73 UJ	1.6	1.13	1.2 UJ	1.4
Surface	Silver	(mg/l)	1	0							0.0002 U	0.0002 U	0.0002	0.0002 U	0.0002 U
Surface	Thallium	(mg/kg)	16	11	68.8	0.78	15	7.05	8	11	0.78	15	7.22	8 U	11
Surface	Thallium	(mg/l)	1	0							0.001 U	0.001 U	0.001	0.001 U	0.001 U
Surface	Zinc	(mg/kg)	20	20	100.0	50.1	422	123	105	190	50.1	422	123	105	190
Surface	Zinc	(mg/l)	1	1	100.0	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Surface	Barium	(mg/kg)	16	16	100.0	86.8	197	166	175	193	86.8	197	166	175	193
Surface	Barium	(mg/l)	1	1	100.0	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03

Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
Surface	Beryllium	(mg/kg)	16	16	100.0	0.41	0.9	0.656	0.66	0.79	0.41	0.9	0.656	0.66	0.79
Surface	Beryllium	(mg/l)	1	0							0.001 U	0.001 U	0.001	0.001 U	0.001 U
Surface	Calcium	(mg/kg)	16	16	100.0	4500	8980	7390	7600	8730	4500	8980	7390	7600	8730
Surface	Calcium	(mg/l)	1	1	100.0	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
Surface	Chromium hexavalent	(mg/kg)	2	2	100.0	0.15 G	0.17 G	0.16	0.15 G	0.15 G	0.15 G	0.17 G	0.16	0.15 G	0.15 G
Surface	Cobalt	(mg/kg)	16	16	100.0	12.1	27	18.5	17.7	26	12.1	27	18.5	17.7	26
Surface	Cobalt	(mg/l)	1	1	100.0	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Surface	Iron	(mg/kg)	16	16	100.0	35000	58600	43700	42500	51000	35000	58600	43700	42500	51000
Surface	Iron	(mg/l)	1	1	100.0	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04
Surface	Magnesium	(mg/kg)	16	16	100.0	3500	7500	6120	6750	7240	3500	7500	6120	6750	7240
Surface	Magnesium	(mg/l)	1	1	100.0	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03
Surface	Potassium	(mg/kg)	16	16	100.0	320	1600	1110	1290	1440	320	1600	1110	1290	1440
Surface	Potassium	(mg/l)	1	1	100.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Surface	Sodium	(mg/kg)	16	16	100.0	330	12700	2370	1170	5760	330	12700	2370	1170	5760
Surface	Sodium	(mg/l)	1	1	100.0	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1
Surface	Titanium	(mg/kg)	2	2	100.0	1740	3200	2470	1740	1740	1740	3200	2470	1740	1740
Surface	Vanadium	(mg/kg)	16	16	100.0	87	160	106	99.6	147	87	160	106	99.6	147
Surface	Vanadium	(mg/l)	1	0							0.003 U	0.003 U	0.003	0.003 U	0.003 U
Surface	2-Methylnaphthalene	(ug/kg)	32	10	31.3	6	430	102	25	280	5 U	430	79.7	20 U	330 U
Surface	Acenaphthene	(ug/kg)	35	17	48.6	4	2400	219	46	370 J	4	2400	153	26	330 U
Surface	Acenaphthylene	(ug/kg)	35	6	17.1	5	250 J	91.8	53	140	5	330 U	66.1	19 U	330 U
Surface	Anthracene	(ug/kg)	35	17	48.6	9	550	122	60	420	5 U	550	104	41	330 U
Surface	Fluorene	(ug/kg)	35	19	54.3	7	1400	140	30	290 J	7	1400	120	27	330 U
Surface	Naphthalene	(ug/kg)	35	14	40.0	7 G	410 J	99.1	31	300	5 UG	410 J	85.5	20 U	330 U
Surface	Phenanthrene	(ug/kg)	35	25	71.4	11 J	2200	329	150	930 J	10 U	2200	276	130	930 J
Surface	Low Molecular Weight PAH	(ug/kg)	35	25	71.4	11 A	6860 A	744	241 A	2246 A	10 UA	6860 A	572	220 A	2246 A
Surface	Dibenz(a,h)anthracene	(ug/kg)	35	14	40.0	4	1700	171	34	150	4	1700	119	20 U	330 U
Surface	Benz(a)anthracene	(ug/kg)	35	27	77.1	10.5	9200	522	170	650 J	10 U	9200	444	170	650 J
Surface	Benzo(a)pyrene	(ug/kg)	35	29	82.9	12.5 J	5900	389	150	790	10 U	5900	360	150	790
Surface	Benzo(b)fluoranthene	(ug/kg)	32	27	84.4	11	11000	545	120	300	10 U	11000	501	140	330 U
Surface	Benzo(g,h,i)perylene	(ug/kg)	35	31	88.6	6.5 J	3100 G	210	76	420 J	6.5 J	3100 G	224	90	420 J
Surface	Benzo(k)fluoranthene	(ug/kg)	31	23	74.2	12.5 J	8300 G	491	110	310	10 U	8300 G	411	110	330 U
Surface	Chrysene	(ug/kg)	35	28	80.0	12.5 J	9500	577	240	860 J	10 U	9500	501	240	860 J
Surface	Fluoranthene	(ug/kg)	35	30	85.7	11.5 J	9100	643	260	1300 J	11.5 J	9100	590	290	1300 J
Surface	Indeno(1,2,3-cd)pyrene	(ug/kg)	35	30	85.7	7 J	4700 G	268	91	340	7 J	4700 G	269	95	340
Surface	Pyrene	(ug/kg)	35	29	82.9	11 J	7200	643	280 G	1400 J	10 U	7200	572	300	1400 J
Surface	Benzo(b+k)fluoranthene	(ug/kg)	34	29	85.3	11 A	19300 A	987	260 A	1100	10 UA	19300 A	881	300 A	1100
Surface	Benzo(j+k)fluoranthene	(ug/kg)	1	1	100.0	28	28	28	28	28	28	28	28	28	28
Surface	High Molecular Weight PAH	(ug/kg)	35	31	88.6	25.5 A	69700 A	4040	1540 A	6800 A	25.5 A	69700 A	3610	707 A	6800 A
Surface	Polycyclic Aromatic Hydrocarbons	(ug/kg)	35	31	88.6	25.5 A	71946 A	4640	1834 A	9360 A	25.5 A	71946 A	4150	778 A	9360 A
Surface	Anthanthrene	(ug/kg)	3	0							79 U	150 U	116	120 U	120 U
Surface	Benzo(e)pyrene	(ug/kg)	4	4	100.0	25	530	306	270	400	25	530	306	270	400
Surface	7,12-Dimethylbenz(a)anthracene	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	1-Chloronaphthalene	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	2-Naphthylamine	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	C1-Dibenzothiophene	(ug/kg)	1	1	100.0	5	5	5	5	5	5	5	5	5	5
Surface	C1-Chrysene	(ug/kg)	1	1	100.0	22	22	22	22	22	22	22	22	22	22
Surface	C1-Fluorene	(ug/kg)	1	1	100.0	3	3	3	3	3	3	3	3	3	3
Surface	C1-Naphthalene	(ug/kg)	1	1	100.0	4	4	4	4	4	4	4	4	4	4
Surface	C1-Fluoranthene/pyrene	(ug/kg)	1	1	100.0	37	37	37	37	37	37	37	37	37	37
Surface	C1-Phenanthrene/anthracene	(ug/kg)	1	1	100.0	20	20	20	20	20	20	20	20	20	20

Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
Surface	C2-Dibenzothiophene	(ug/kg)	1	1	100.0	10	10	10	10	10	10	10	10	10	10
Surface	C2-Chrysene	(ug/kg)	1	1	100.0	16	16	16	16	16	16	16	16	16	16
Surface	C2-Fluorene	(ug/kg)	1	1	100.0	8	8	8	8	8	8	8	8	8	8
Surface	C2-Naphthalene	(ug/kg)	1	1	100.0	10	10	10	10	10	10	10	10	10	10
Surface	C2-Fluoranthene/pyrene	(ug/kg)	1	1	100.0	27	27	27	27	27	27	27	27	27	27
Surface	C2-Phenanthrene/anthracene	(ug/kg)	1	1	100.0	29	29	29	29	29	29	29	29	29	29
Surface	C3-Dibenzothiophene	(ug/kg)	1	1	100.0	11	11	11	11	11	11	11	11	11	11
Surface	C3-Chrysene	(ug/kg)	1	1	100.0	11	11	11	11	11	11	11	11	11	11
Surface	C3-Fluorene	(ug/kg)	1	1	100.0	20	20	20	20	20	20	20	20	20	20
Surface	C3-Naphthalene	(ug/kg)	1	1	100.0	10	10	10	10	10	10	10	10	10	10
Surface	C3-Fluoranthene/pyrene	(ug/kg)	1	1	100.0	18	18	18	18	18	18	18	18	18	18
Surface	C3-Phenanthrene/anthracene	(ug/kg)	1	1	100.0	28	28	28	28	28	28	28	28	28	28
Surface	C4-Dibenzothiophene	(ug/kg)	1	1	100.0	12	12	12	12	12	12	12	12	12	12
Surface	C4-Chrysene	(ug/kg)	1	1	100.0	4	4	4	4	4	4	4	4	4	4
Surface	C4-Naphthalene	(ug/kg)	1	1	100.0	9	9	9	9	9	9	9	9	9	9
Surface	C4-Phenanthrene/anthracene	(ug/kg)	1	1	100.0	10	10	10	10	10	10	10	10	10	10
Surface	Total benzofluoranthenes (b+k (+j))	(ug/kg)	1	1	100.0	62	62	62	62	62	62	62	62	62	62
Surface	4,4'-DDD	(ug/kg)	32	26	81.3	8.2	11000	745	100 J	2300	0.4 UJ	11000	607	100	2300
Surface	4,4'-DDE	(ug/kg)	32	18	56.3	2.4 J	1480	186	34	522	0.54 U	1480	138	50 J	509
Surface	4,4'-DDT	(ug/kg)	32	29	90.6	17	81000	4360	490	10000	16 U	81000	3960	410	10000
Surface	Total of 3 isomers: pp-DDT,-DDD,-DDE	(ug/kg)	32	31	96.9	8.2 A	84909 A	4810	580 A	12822 A	8.2 A	84909 A	4660	566 A	12822 A
Surface	Aldrin	(ug/kg)	32	0							0.4 UJ	99 U	30	10 U	97 U
Surface	alpha-Hexachlorocyclohexane	(ug/kg)	20	0							0.4 UJ	99 U	33.9	19 U	99 U
Surface	beta-Hexachlorocyclohexane	(ug/kg)	32	0							0.4 UJ	99 U	28.7	10 U	97 U
Surface	delta-Hexachlorocyclohexane	(ug/kg)	32	0							0.4 UJ	99 U	29.1	10 U	97 U
Surface	gamma-Hexachlorocyclohexane	(ug/kg)	32	0							0.4 UJ	99 U	28.7	10 U	97 U
Surface	cis-Chlordane	(ug/kg)	28	0							0.45 U	110 U	34.2	19 U	99 U
Surface	Dieldrin	(ug/kg)	32	0							0.4 UJ	235 U	60.9	19 U	200 U
Surface	alpha-Endosulfan	(ug/kg)	32	0							0.4 UJ	99 U	28.7	10 U	97 U
Surface	beta-Endosulfan	(ug/kg)	32	0							0.4 UJ	200 U	49.9	19 U	190 U
Surface	Endosulfan sulfate	(ug/kg)	32	1	3.1	240	240	240	240	240	0.4 UJ	240	56.2	19 U	200 U
Surface	Endrin	(ug/kg)	32	0							0.4 UJ	200 U	49.9	19 U	190 U
Surface	Endrin aldehyde	(ug/kg)	32	2	6.3	0.56 J	215	108	0.56 J	0.56 J	0.56 J	215	54	19 U	200 U
Surface	Endrin ketone	(ug/kg)	32	0							0.45 U	200 U	49.9	19 U	190 U
Surface	Heptachlor	(ug/kg)	32	0							0.4 UJ	99 U	28.7	10 U	97 U
Surface	Heptachlor epoxide	(ug/kg)	32	0							0.4 UJ	360 U	39.7	10 U	99 U
Surface	Methoxychlor	(ug/kg)	32	0							0.8 UJ	990 U	223	80 U	970 U
Surface	Toxaphene	(ug/kg)	32	0							17 UJ	9900 U	2740	960 U	9700 U
Surface	Azinphosmethyl	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Bromoxynil	(ug/kg)	4	0							25 U	250 U	105	25 U	120 U
Surface	gamma-Chlordane	(ug/kg)	28	0							0.45 U	99 U	31.7	19 U	97 U
Surface	Chlordane (cis & trans)	(ug/kg)	4	0							80 U	80 U	80	80 U	80 U
Surface	Chlorpyrifos	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Coumaphos	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Demeton	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Diazinon	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Dichlorvos	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Diphenyl	(ug/kg)	1	1	100.0	2	2	2	2	2	2	2	2	2	2
Surface	Disulfoton	(ug/kg)	4	1	25.0	56	56	56	56	56	50 U	56	51.5	50 U	50 U
Surface	Ethoprop	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Fensulfothion	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U

Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
Surface	Fenthion	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Hexachlorocyclohexanes	(ug/kg)	12	0							10 U	40 U	20	10 U	40 U
Surface	Malathion	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Merphos	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Methyl parathion	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Mevinphos	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Naled	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Perthane	(ug/kg)	4	0							100 U	100 U	100	100 U	100 U
Surface	Phorate	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Prothiophos	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Ronnel	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Stirofos	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Sulprofos	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Tetraethyl pyrophosphate	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Trichloronate	(ug/kg)	4	0							50 U	50 U	50	50 U	50 U
Surface	Diesel fuels	(mg/kg)	2	1	50.0	50 G	50 G	50	50 G	50 G	50 U	50 G	50	50 U	50 U
Surface	Heavy oil	(mg/kg)	1	1	100.0	96	96	96	96	96	96	96	96	96	96
Surface	Lube Oil	(mg/kg)	2	0							100 U	100 U	100	100 U	100 U
Surface	Natural gasoline	(mg/kg)	2	0							20 U	20 U	20	20 U	20 U
Surface	2,3,4,6-Tetrachlorophenol	(ug/kg)	7	0							79 UJ	1600 U	964	1600 U	1600 U
Surface	2,4,5-Trichlorophenol	(ug/kg)	32	0							40 U	330 U	118	96 U	330 U
Surface	2,4,6-Trichlorophenol	(ug/kg)	32	0							30 U	150 U	69.9	79 U	120 U
Surface	2,4-Dichlorophenol	(ug/kg)	32	0							23 U	300 U	87.3	60 U	160 U
Surface	2,4-Dimethylphenol	(ug/kg)	32	0							19 U	200 U	93.8	26 U	200 U
Surface	2,4-Dinitrophenol	(ug/kg)	23	0							23 U	300 UG	185	190 UJ	300 UJ
Surface	2-Chlorophenol	(ug/kg)	32	0							19 U	150 U	41.8	26 U	79 U
Surface	2-Methylphenol	(ug/kg)	28	0							19 U	590 U	102	100 U	320 U
Surface	2-Nitrophenol	(ug/kg)	20	0							23 U	150 U	87.6	97 U	120 U
Surface	4,6-Dinitro-2-methylphenol	(ug/kg)	32	0							45 U	590 U	168	120 U	320 U
Surface	4-Chloro-3-methylphenol	(ug/kg)	32	0							23 U	300 U	60.7	40 U	160 U
Surface	4-Methylphenol	(ug/kg)	16	12	75.0	42	580	289	260	570	19 U	580	250	200	570
Surface	4-Nitrophenol	(ug/kg)	29	0							45 U	300 U	111	100 UG	240 U
Surface	Pentachlorophenol	(ug/kg)	24	1	4.2	680	680	680	680	680	45 U	680	159	98 U	300 UG
Surface	Phenol	(ug/kg)	32	0							19 U	300 U	52.8	26 U	160 U
Surface	2,3,4,5-Tetrachlorophenol	(ug/kg)	3	0							79 UJ	150 U	116	120 U	120 U
Surface	2,4-Dichloro-6-methylphenol	(ug/kg)	4	0							200 U	570 U	300	200 U	230 U
Surface	2,6-Dichlorophenol	(ug/kg)	7	0							130 U	370 U	211	160 U	300 U
Surface	3- and 4-Methylphenol Coelution	(ug/kg)	6	0							200 U	200 U	200	200 UJ	200 UJ
Surface	4-Chloro-o-cresol	(ug/kg)	4	0							81 U	230 U	121	82 U	92 U
Surface	4-Chlorophenol	(ug/kg)	4	0							330 U	910 U	485	330 U	370 U
Surface	Cresol	(ug/kg)	4	0							41 U	110 U	59.5	41 U	46 U
Surface	Dimethyl phthalate	(ug/kg)	32	1	3.1	25	25	25	25	25	10 U	330 U	55.6	19 U	330 U
Surface	Diethyl phthalate	(ug/kg)	32	0							10 U	330 U	55.1	19 U	330 U
Surface	Dibutyl phthalate	(ug/kg)	32	8	25.0	12	640	135	39	180	10 UG	640	85.2	20 U	330 U
Surface	Butylbenzyl phthalate	(ug/kg)	32	2	6.3	15	17 G	16	15	15	10 U	330 U	55.5	19 U	330 U
Surface	Di-n-octyl phthalate	(ug/kg)	32	0							10 UG	330 U	55.1	19 U	330 U
Surface	Bis(2-ethylhexyl) phthalate	(ug/kg)	32	22	68.8	21	1800	404	260	1000	20 UG	1800	328	250	1000
Surface	1,2-Diphenylhydrazine	(ug/kg)	4	0							1600 U	1600 U	1600	1600 U	1600 U
Surface	Bis(2-chloro-1-methylethyl) ether	(ug/kg)	29	0							10 U	330 U	58.4	19 UJ	330 U
Surface	2,4-Dinitrotoluene	(ug/kg)	32	0							20 U	330 U	110	96 U	330 U
Surface	2,6-Dinitrotoluene	(ug/kg)	32	0							10 U	330 U	95.5	96 U	330 U

Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
Surface	2-Chloronaphthalene	(ug/kg)	32	0							5 U	330 U	53.2	19 U	330 U
Surface	2-Nitroaniline	(ug/kg)	32	0							10 U	3000 U	462	96 UJ	1600 U
Surface	3,3'-Dichlorobenzidine	(ug/kg)	32	0							40 UG	660 U	164	96 U	660 U
Surface	3-Nitroaniline	(ug/kg)	32	0							110 UJ	3000 U	542	200 UG	1600 U
Surface	4-Bromophenyl phenyl ether	(ug/kg)	32	0							10 U	330 U	63.8	19 U	330 U
Surface	4-Chloroaniline	(ug/kg)	32	0							50 U	590 U	127	58 U	330 U
Surface	4-Chlorophenyl phenyl ether	(ug/kg)	32	0							10 U	330 U	57.3	19 U	330 U
Surface	4-Nitroaniline	(ug/kg)	32	0							10 U	3000 U	462	96 U	1600 U
Surface	Aniline	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	Benzoic acid	(ug/kg)	29	1	3.4	1200	1200	1200	1200	1200	190 UJ	1200 U	320	250 U	790 U
Surface	Benzyl alcohol	(ug/kg)	32	0							19 UJ	330 U	89.8	50 UG	330 U
Surface	Bis(2-chloroethoxy) methane	(ug/kg)	32	0							10 U	330 U	55.1	19 U	330 U
Surface	Bis(2-chloroethyl) ether	(ug/kg)	32	0							10 U	330 U	65.2	38 U	330 U
Surface	Carbazole	(ug/kg)	28	8	28.6	13	700 J	147	40 J	260	10 UG	700 J	54.5	19 U	59
Surface	Dibenzofuran	(ug/kg)	33	12	36.4	4	170 J	69.9	47	160	4	330 U	72	20 U	330 U
Surface	Hexachlorobenzene	(ug/kg)	28	2	7.1	19 J	340	180	19 J	19 J	10 U	340	30	19 U	48 U
Surface	Hexachlorobutadiene	(ug/kg)	32	2	6.3	200	270	235	200	200	10 U	330 U	77.6	19 U	330 U
Surface	Hexachlorocyclopentadiene	(ug/kg)	20	0							94 U	330 U	159	99 U	330 U
Surface	Hexachloroethane	(ug/kg)	32	3	9.4	38	1600	562	49	49	19 U	1600	136	40 UG	330 U
Surface	Isophorone	(ug/kg)	32	0							10 U	330 U	55.1	19 U	330 U
Surface	Nitrobenzene	(ug/kg)	32	0							10 U	330 U	63.8	19 U	330 U
Surface	N-Nitrosodimethylamine	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	N-Nitrosodipropylamine	(ug/kg)	32	0							10 U	330 U	82.7	38 U	330 U
Surface	N-Nitrosodiphenylamine	(ug/kg)	32	0							10 U	330 U	57.4	19 U	330 U
Surface	1-Naphthylamine	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	2-Picoline	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	3-Methylcholanthrene	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	4-Aminobiphenyl	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	Acetophenone	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	alpha,alpha-Dimethylphenethylamine	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	Benzidine	(ug/kg)	4	0							1600 U	1600 U	1600	1600 U	1600 U
Surface	Bis(2-chloroisopropyl) ether	(ug/kg)	3	0							320 UJ	590 U	463	480 U	480 U
Surface	Dibenzothiophene	(ug/kg)	1	1	100.0	4	4	4	4	4	4	4	4	4	4
Surface	Diphenylamine	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	Ethyl methanesulfonate	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	Methyl methanesulfonate	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	N-Nitrosodibutylamine	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	N-Nitrosopiperidine	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	p-Dimethylaminoazobenzene	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	Pentachloronitrobenzene	(ug/kg)	4	0							1600 U	1600 U	1600	1600 U	1600 U
Surface	Perylene	(ug/kg)	1	1	100.0	24	24	24	24	24	24	24	24	24	24
Surface	Phenacetin	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	Pronamide	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	1,1,1,2-Tetrachloroethane	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	1,1,1-Trichloroethane	(ug/kg)	16	0							1 U	11 U	5.75	5 U	10 U
Surface	1,1,2,2-Tetrachloroethane	(ug/kg)	16	0							2 U	11 U	6	5 U	10 U
Surface	1,1,2-Trichloroethane	(ug/kg)	16	0							2 U	11 U	6	5 U	10 U
Surface	1,1-Dichloroethane	(ug/kg)	16	0							1 U	11 U	5.75	5 U	10 U
Surface	Vinylidene chloride	(ug/kg)	16	0							1 U	11 U	5.75	5 U	10 U
Surface	1,2,3-Trichloropropane	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	1,2-Dichloroethane	(ug/kg)	16	0							2 U	11 U	6	5 U	10 U

Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
Surface	1,2-Dichloropropane	(ug/kg)	16	0							2 U	11 U	6	5 U	10 U
Surface	2-Chloroethyl vinyl ether	(ug/kg)	4	0							10 U	10 U	10	10 U	10 U
Surface	Methyl N-butyl ketone	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	Benzene	(ug/kg)	18	2	11.1	1.3	1.4	1.35	1.3	1.3	1 U	300 U	38.5	5 U	300 U
Surface	Bromochloromethane	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	Bromodichloromethane	(ug/kg)	16	0							2 U	11 U	6	5 U	10 U
Surface	Bromoform	(ug/kg)	16	0							5 U	11 U	8	9 U	10 U
Surface	Bromomethane	(ug/kg)	16	0							5 UJ	11 U	8	9 UG	10 U
Surface	Carbon disulfide	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	Carbon tetrachloride	(ug/kg)	16	0							1 U	11 U	5.75	5 U	10 U
Surface	Chlorodibromomethane	(ug/kg)	16	0							2 U	11 U	6	5 U	10 U
Surface	Chloroethane	(ug/kg)	16	0							5 U	11 U	8	9 U	10 U
Surface	Chloroform	(ug/kg)	16	0							1 U	11 U	5.75	5 U	10 U
Surface	Chloromethane	(ug/kg)	16	0							5 UJ	11 U	8	9 UG	10 U
Surface	cis-1,3-Dichloropropene	(ug/kg)	16	0							4 U	11 U	6.5	5 U	10 U
Surface	Methylene bromide	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	Dichlorodifluoromethane	(ug/kg)	16	0							5 UJ	20 U	10.5	9 UG	20 U
Surface	Ethylbenzene	(ug/kg)	18	0							1 U	300 U	38.4	5 U	300 U
Surface	Isopropylbenzene	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	m,p-Xylene	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	Methylene chloride	(ug/kg)	16	0							10 U	22 U	13.6	10 U	21 U
Surface	o-Xylene	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	Styrene	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	Tetrachloroethene	(ug/kg)	16	0							1 U	11 U	5.75	5 U	10 U
Surface	Toluene	(ug/kg)	18	0							1 U	300 U	38.4	5 U	300 U
Surface	trans-1,2-Dichloroethene	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	trans-1,3-Dichloropropene	(ug/kg)	16	0							2 U	11 U	6	5 U	10 U
Surface	Trichloroethene	(ug/kg)	16	0							1 U	11 U	5.75	5 U	10 U
Surface	Trichlorofluoromethane	(ug/kg)	16	0							5 UJ	20 U	10.5	9 UG	20 U
Surface	Vinyl chloride	(ug/kg)	16	0							2 U	11 U	6	5 U	10 U
Surface	1,1,2-Trichloro-1,2,2-trifluoroethane	(ug/kg)	4	0							10 U	10 U	10	10 U	10 U
Surface	1,1-Dichloropropene	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	1,2-Dibromo-3-chloropropane	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	1,3,5-Trimethylbenzene	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	1,3-Dichloropropane	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	2,2-Dichloropropane	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	2-Chlorotoluene	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	4-Chlorotoluene	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	Bromobenzene	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	cis-1,2-Dichloroethene	(ug/kg)	12	0							5 U	11 U	7.33	5 U	10 U
Surface	Ethylene dibromide	(ug/kg)	16	0							4 U	44 U	23.1	20 U	42 U
Surface	n-Butylbenzene	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	n-Propylbenzene	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	Pseudocumene	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	Sec-butylbenzene	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 UJ
Surface	tert-Butylbenzene	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	1,2-Dichloroethene	(ug/kg)	4	0							1 U	1 U	1	1 U	1 U
Surface	Cymene	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	Xylene	(ug/kg)	6	0							2 U	300 U	101	2 U	300 U
Surface	Chlorobenzene	(ug/kg)	16	5	31.3	4.6	34000	6880	130	250	1 U	34000	2150	5 U	250
Surface	1,2-Dichlorobenzene	(ug/kg)	32	3	9.4	4.8	1700 J	576	22	22	2 U	1700 J	67.6	11 UG	48 UJ

Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
Surface	1,3-Dichlorobenzene	(ug/kg)	32	0							2 U	59 UJ	15.3	11 UG	32 UJ
Surface	1,4-Dichlorobenzene	(ug/kg)	32	2	6.3	4.8	530	267	4.8	4.8	2 U	530	30.9	11 UG	48 UJ
Surface	1,2,3-Trichlorobenzene	(ug/kg)	12	0							20 U	44 U	29.5	20 U	42 U
Surface	1,2,4-Trichlorobenzene	(ug/kg)	32	2	6.3	10	190	100	10	10	10 U	330 U	69.4	19 U	330 U
Surface	1,2,4,5-Tetrachlorobenzene	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Surface	Pentachlorobenzene	(ug/kg)	4	0							330 U	330 U	330	330 U	330 U
Subsurface	Aroclor 1016	(ug/kg)	5	0							80 UG	75000 U	16900	1600 U	7500 U
Subsurface	Aroclor 1242	(ug/kg)	5	0							80 UG	75000 U	16900	1600 U	7500 U
Subsurface	Aroclor 1248	(ug/kg)	5	0							80 UG	75000 U	16900	1600 U	7500 U
Subsurface	Aroclor 1254	(ug/kg)	5	0							80 UG	75000 U	16900	1600 U	7500 U
Subsurface	Aroclor 1260	(ug/kg)	5	0							80 UG	75000 U	16900	1600 U	7500 U
Subsurface	Aroclor 1221	(ug/kg)	3	0							3100 U	150000 U	56000	15000 U	15000 U
Subsurface	Aroclor 1232	(ug/kg)	3	0							1600 U	75000 U	28000	7500 U	7500 U
Subsurface	Polychlorinated biphenyl	(ug/kg)	5	0							80 UA	150000 UA	33700	3100 UA	15000 UA
Subsurface	Butyltin ion	(ug/kg)	1	0							14 U	14 U	14	14 U	14 U
Subsurface	Dibutyltin ion	(ug/kg)	1	0							14 U	14 U	14	14 U	14 U
Subsurface	Tributyltin ion	(ug/kg)	1	0							14 U	14 U	14	14 U	14 U
Subsurface	Tetrabutyltin	(ug/kg)	1	0							14 U	14 U	14	14 U	14 U
Subsurface	Total solids	(%)	40	40	100.0	46.4	80.9	63.6	64.5	78.4	46.4	80.9	63.6	64.5	78.4
Subsurface	Total organic carbon	(%)	22	20	90.9	0.08	2.8	1.48	1.4	2.7	0.05 U	2.8	1.35	1.4	2.42
Subsurface	Total volatile solids	(%)	3	3	100.0	7.2	8.2	7.67	7.6	7.6	7.2	8.2	7.67	7.6	7.6
Subsurface	Bromine	(ug/kg)	1	1	100.0	13	13	13	13	13	13	13	13	13	13
Subsurface	Chlorine	(ug/kg)	1	1	100.0	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380
Subsurface	2,3,7,8-Tetrachlorodibenzo-p-dioxin	(ng/kg)	3	1	33.3	0.63	0.63	0.63	0.63	0.63	0.63	6.9 U	2.76	0.76 U	0.76 U
Subsurface	Tetrachlorodibenzo-p-dioxin	(ng/kg)	1	1	100.0	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Subsurface	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	(ng/kg)	3	1	33.3	1.2	1.2	1.2	1.2	1.2	1.2	6.9 U	3.23	1.6 U	1.6 U
Subsurface	Pentachlorodibenzo-p-dioxin	(ng/kg)	2	1	50.0	1.2	1.2	1.2	1.2	1.2	1.2	1.6 U	1.4	1.2	1.2
Subsurface	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	(ng/kg)	3	1	33.3	1.2	1.2	1.2	1.2	1.2	1.2	11 U	4.47	1.2 U	1.2 U
Subsurface	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	(ng/kg)	3	2	66.7	17	22	19.5	17	17	3.1 U	22	14	17	17
Subsurface	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	(ng/kg)	3	2	66.7	8.6	13	10.8	8.6	8.6	1.4 U	13	7.67	8.6	8.6
Subsurface	Hexachlorodibenzo-p-dioxin	(ng/kg)	1	1	100.0	130	130	130	130	130	130	130	130	130	130
Subsurface	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	(ng/kg)	3	3	100.0	29	290	176	210	210	29	290	176	210	210
Subsurface	Heptachlorodibenzo-p-dioxin	(ng/kg)	1	1	100.0	630	630	630	630	630	630	630	630	630	630
Subsurface	Octachlorodibenzo-p-dioxin	(ng/kg)	3	3	100.0	180	2700	1660	2100	2100	180	2700	1660	2100	2100
Subsurface	2,3,7,8-Tetrachlorodibenzofuran	(ng/kg)	3	3	100.0	84	15000	5060	110	110	84	15000	5060	110	110
Subsurface	Tetrachlorodibenzofuran	(ng/kg)	1	1	100.0	270	270	270	270	270	270	270	270	270	270
Subsurface	1,2,3,7,8-Pentachlorodibenzofuran	(ng/kg)	3	2	66.7	49	360	205	49	49	49	18000 U	6140	360	360
Subsurface	2,3,4,7,8-Pentachlorodibenzofuran	(ng/kg)	3	3	100.0	57	11000	3710	61	61	57	11000	3710	61	61
Subsurface	Pentachlorodibenzofuran	(ng/kg)	2	2	100.0	150	680	415	150	150	150	680	415	150	150
Subsurface	1,2,3,4,7,8-Hexachlorodibenzofuran	(ng/kg)	3	3	100.0	110 J	22000 J	7600	700	700	110 J	22000 J	7600	700	700
Subsurface	1,2,3,6,7,8-Hexachlorodibenzofuran	(ng/kg)	3	2	66.7	26 J	150	88	26 J	26 J	26 J	5600 UJ	1930	150	150
Subsurface	1,2,3,7,8,9-Hexachlorodibenzofuran	(ng/kg)	3	3	100.0	22	2700	916	25	25	22	2700	916	25	25
Subsurface	2,3,4,6,7,8-Hexachlorodibenzofuran	(ng/kg)	3	3	100.0	10	1300	443	18	18	10	1300	443	18	18
Subsurface	Hexachlorodibenzofuran	(ng/kg)	2	2	100.0	210	1200	705	210	210	210	1200	705	210	210
Subsurface	1,2,3,4,6,7,8-Heptachlorodibenzofuran	(ng/kg)	3	3	100.0	34	5400	1900	270	270	34	5400	1900	270	270
Subsurface	1,2,3,4,7,8,9-Heptachlorodibenzofuran	(ng/kg)	3	3	100.0	20	2200	790	150	150	20	2200	790	150	150
Subsurface	Heptachlorodibenzofuran	(ng/kg)	1	1	100.0	650	650	650	650	650	650	650	650	650	650
Subsurface	Octachlorodibenzofuran	(ng/kg)	3	3	100.0	82	4900	1840	530	530	82	4900	1840	530	530
Subsurface	Gravel	(%)	16	14	87.5	0.1	14.9	2.59	0.49	5.3	0.1	14.9	2.45	0.49	5.3
Subsurface	Sand	(%)	19	17	89.5	11.7	94.5	41.2	27.79	83.4	11.7	99.6 U	47.2	30.1	96.8 U
Subsurface	Fines	(%)	19	19	100.0	0.13	88.3	50.8	66.3	84.6	0.13	88.3	50.8	66.3	84.6

Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or			Number	Number	%	Detected Concentrations					Detected and Nondetected Concentrations				
Subsurface	Analyte	Units	of Samples	Detected	Detected	Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
Subsurface	Silt	(%)	19	17	89.5	0.12	77.3	47.9	57.4	73.1	0.08 U	77.3	42.9	53.73	73.1
Subsurface	Clay	(%)	19	17	89.5	0.12	17.34	8.77	8.9	15.2	0.05 U	17.34	7.86	6.9	15.2
Subsurface	Mean grain size	(mm)	3	3	100.0	0.03	0.04	0.0337	0.0312	0.0312	0.03	0.04	0.0337	0.0312	0.0312
Subsurface	Median grain size	(mm)	3	3	100.0	0.018	0.021	0.0197	0.02	0.02	0.018	0.021	0.0197	0.02	0.02
Subsurface	Aluminum	(mg/kg)	4	4	100.0	34100	39100	36800	36500	37500	34100	39100	36800	36500	37500
Subsurface	Antimony	(mg/kg)	4	0							4 UJ	5 UJ	4.75	5 UJ	5 UJ
Subsurface	Arsenic	(mg/kg)	6	2	33.3	3.5 G	5.1 G	4.3	3.5 G	3.5 G	3.5 G	5.1 G	4.6	5 U	5 U
Subsurface	Cadmium	(mg/kg)	6	6	100.0	0.36 G	0.8	0.558	0.4	0.7	0.36 G	0.8	0.558	0.4	0.7
Subsurface	Chromium	(mg/kg)	6	6	100.0	24 G	43.3	34.9	33	42.9	24 G	43.3	34.9	33	42.9
Subsurface	Copper	(mg/kg)	6	6	100.0	37.1	57.4	50.2	51.2	53.6	37.1	57.4	50.2	51.2	53.6
Subsurface	Lead	(mg/kg)	8	8	100.0	2.6	44	26.7	31	43	2.6	44	26.7	31	43
Subsurface	Manganese	(mg/kg)	6	6	100.0	435	676 G	532	475 G	663	435	676 G	532	475 G	663
Subsurface	Mercury	(mg/kg)	6	6	100.0	0.077 G	0.28	0.17	0.14 G	0.23	0.077 G	0.28	0.17	0.14 G	0.23
Subsurface	Nickel	(mg/kg)	6	6	100.0	27.9	60.7	38.7	31.4	42 G	27.9	60.7	38.7	31.4	42 G
Subsurface	Selenium	(mg/kg)	4	4	100.0	6	12	9.5	9	11	6	12	9.5	9	11
Subsurface	Silver	(mg/kg)	4	4	100.0	0.7	1.5	1.1	1.1	1.1	0.7	1.5	1.1	1.1	1.1
Subsurface	Thallium	(mg/kg)	4	1	25.0	12	12	12	12	12	4 U	12	6.5	5 U	5 U
Subsurface	Zinc	(mg/kg)	6	6	100.0	137 G	243	172	159 G	181	137 G	243	172	159 G	181
Subsurface	Barium	(mg/kg)	4	4	100.0	192	330	252	205	281	192	330	252	205	281
Subsurface	Beryllium	(mg/kg)	4	4	100.0	0.47	0.55	0.515	0.5	0.54	0.47	0.55	0.515	0.5	0.54
Subsurface	Calcium	(mg/kg)	4	4	100.0	7440	13800	9310	7560	8450	7440	13800	9310	7560	8450
Subsurface	Cobalt	(mg/kg)	4	4	100.0	16.2	17.8	16.9	16.7	16.9	16.2	17.8	16.9	16.7	16.9
Subsurface	Iron	(mg/kg)	6	6	100.0	33200 G	40000	38000	38200	39900	33200 G	40000	38000	38200	39900
Subsurface	Magnesium	(mg/kg)	4	4	100.0	6540	7370	6860	6740	6770	6540	7370	6860	6740	6770
Subsurface	Potassium	(mg/kg)	4	4	100.0	1140	1280	1210	1200	1200	1140	1280	1210	1200	1200
Subsurface	Sodium	(mg/kg)	4	4	100.0	1230 J	4480 J	2450	1910 J	2180 J	1230 J	4480 J	2450	1910 J	2180 J
Subsurface	Titanium	(mg/kg)	1	1	100.0	1950	1950	1950	1950	1950	1950	1950	1950	1950	1950
Subsurface	Vanadium	(mg/kg)	4	4	100.0	99.7	107	102	99.8	101	99.7	107	102	99.8	101
Subsurface	2-Methylnaphthalene	(ug/kg)	16	11	68.8	8 J	610	122	20	250	5 U	610	85.4	15	250
Subsurface	Acenaphthene	(ug/kg)	20	13	65.0	12.5 J	820	163	71	290	10 U	820	125	50 U	290
Subsurface	Acenaphthylene	(ug/kg)	20	10	50.0	11	60	33.2	22.5 J	49	10 U	150 UG	37.6	20	150 UG
Subsurface	Anthracene	(ug/kg)	20	14	70.0	11 J	870	195	100	550	5 U	870	187	82	550
Subsurface	Fluorene	(ug/kg)	20	12	60.0	10.5 J	620	193	55	600	10 U	620	143	50 U	600
Subsurface	Naphthalene	(ug/kg)	22	12	54.5	9	1100	192	35	590	5 U	1100	121	35	240
Subsurface	Phenanthrene	(ug/kg)	20	14	70.0	97 J	15000	2540	260	13000	10 U	15000	1820	210	13000
Subsurface	Low Molecular Weight PAH	(ug/kg)	20	14	70.0	131 A	16780 A	3240	415 A	15288 A	10 UA	16780 A	2320	392 A	15288 A
Subsurface	Dibenz(a,h)anthracene	(ug/kg)	20	14	70.0	6 J	1800 G	251	63	990	5 U	1800 G	244	50 U	990
Subsurface	Benz(a)anthracene	(ug/kg)	20	16	80.0	14.5 J	13000	1200	330	1800	10 U	13000	1010	330	1800
Subsurface	Benzo(a)pyrene	(ug/kg)	20	16	80.0	13 J	9600	932	230	950	10 U	9600	817	230	950
Subsurface	Benzo(b)fluoranthene	(ug/kg)	18	17	94.4	14.5	9700	1180	230	5600	10 U	9700	1120	200	5600
Subsurface	Benzo(g,h,i)perylene	(ug/kg)	20	18	90.0	7 J	4300	556	140	1800	7 J	4300	641	200	1800
Subsurface	Benzo(k)fluoranthene	(ug/kg)	18	17	94.4	11 J	16000	1320	170	3000	10 U	16000	1250	150	3000
Subsurface	Chrysene	(ug/kg)	20	18	90.0	12 J	16000	1670	340	7100	10 U	16000	1530	340	7100
Subsurface	Fluoranthene	(ug/kg)	20	17	85.0	13.5 J	23000	2590	440	10000	10 U	23000	2280	440	10000
Subsurface	Indeno(1,2,3-cd)pyrene	(ug/kg)	20	18	90.0	7 J	7000	660	200	1400	7 J	7000	659	205 J	1400
Subsurface	Pyrene	(ug/kg)	20	17	85.0	13 J	18000	2160	590	6000	10 U	18000	1930	590	6000
Subsurface	Benzo(b+k)fluoranthene	(ug/kg)	20	19	95.0	27.5 A	25700 A	2370	610 G	8600 A	10 UA	25700 A	2250	400 A	8600 A
Subsurface	High Molecular Weight PAH	(ug/kg)	20	20	100.0	14 A	118400 A	10800	1982 A	38200 A	14 A	118400 A	10800	1982 A	38200 A
Subsurface	Polycyclic Aromatic Hydrocarbons	(ug/kg)	20	20	100.0	14 A	135180 A	13000	2281 A	53488 A	14 A	135180 A	13000	2281 A	53488 A
Subsurface	4,4'-DDD	(ug/kg)	55	48	87.3	10	690000	47100	310	240000	6.2 U	690000	41100	220	240000
Subsurface	4,4'-DDE	(ug/kg)	55	26	47.3	8.1	24000	2110	310	9000	5.4 UI	24000	1340	92 U	7500 U

Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations					Detected and Nondetected Concentrations				
						Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
Subsurface	4,4'-DDT	(ug/kg)	218	83	38.1	11	4500000	148000	27000	200000	6.2 U	4500000	85700	50000 U	110000
Subsurface	Total of 3 isomers: pp-DDT,-DDD,-DDE	(ug/kg)	55	52	94.5	8.1 A	4764000 A	223000	1900 A	800000 A	6.2 UA	4764000 A	211000	1270 A	800000 A
Subsurface	Aldrin	(ug/kg)	55	0							0.96 U	3800 U	247	11 UJ	1800 U
Subsurface	alpha-Hexachlorocyclohexane	(ug/kg)	43	1	2.3	120	120	120	120	120	0.96 U	3800 U	229	70 U	380 U
Subsurface	beta-Hexachlorocyclohexane	(ug/kg)	55	2	3.6	77	120	98.5	77	77	0.96 U	3800 U	182	11 UJ	400 U
Subsurface	delta-Hexachlorocyclohexane	(ug/kg)	55	0							0.96 U	3800 UJ	181	11 UJ	400 U
Subsurface	gamma-Hexachlorocyclohexane	(ug/kg)	55	1	1.8	45.9	45.9	45.9	45.9	45.9	0.96 U	3800 U	182	11 UJ	400 U
Subsurface	cis-Chlordane	(ug/kg)	53	0							0.96 U	3800 UJ	189	11 UJ	400 U
Subsurface	trans-Chlordane	(ug/kg)	37	3	8.1	140 J	410 J	240	170 J	170 J	6.2 U	1800 U	173	11 UJ	440 U
Subsurface	Dieldrin	(ug/kg)	55	0							1.9 U	7500 U	257	11 UJ	750 U
Subsurface	alpha-Endosulfan	(ug/kg)	55	0							0.96 U	3800 U	185	12 UG	400 U
Subsurface	beta-Endosulfan	(ug/kg)	55	0							1.9 U	38000 U	922	11 UJ	750 U
Subsurface	Endosulfan sulfate	(ug/kg)	55	1	1.8	290	290	290	290	290	1.9 U	7500 UJ	260	11 UJ	750 UJ
Subsurface	Endrin	(ug/kg)	55	1	1.8	190 J	190 J	190	190 J	190 J	1.9 U	22000 U	634	11 UJ	750 U
Subsurface	Endrin aldehyde	(ug/kg)	53	0							1.9 U	7500 U	266	11 UJ	750 U
Subsurface	Endrin ketone	(ug/kg)	55	1	1.8	120	120	120	120	120	1.9 U	7500 UJ	257	11 UJ	750 UJ
Subsurface	Heptachlor	(ug/kg)	55	0							0.96 U	3800 U	181	11 UJ	400 U
Subsurface	Heptachlor epoxide	(ug/kg)	55	2	3.6	89	110	99.5	89	89	0.96 U	3800 U	182	11 UJ	400 U
Subsurface	Methoxychlor	(ug/kg)	55	0							6.2 U	38000 U	879	20 U	1400 U
Subsurface	Toxaphene	(ug/kg)	55	0							96 U	380000 U	15800	710 U	50000 U
Subsurface	gamma-Chlordane	(ug/kg)	16	0							0.96 U	3800 U	305	10 U	400 U
Subsurface	Chlordane (cis & trans)	(ug/kg)	2	0							40 UG	40 UG	40	40 UG	40 UG
Subsurface	Hexachlorocyclohexanes	(ug/kg)	12	0							10 U	400 U	51.3	10 U	40 U
Subsurface	Diesel fuels	(mg/kg)	1	0							50 U	50 U	50	50 U	50 U
Subsurface	Lube Oil	(mg/kg)	1	0							100 U	100 U	100	100 U	100 U
Subsurface	Natural gasoline	(mg/kg)	1	0							20 U	20 U	20	20 U	20 U
Subsurface	2,4,5-Trichlorophenol	(ug/kg)	16	1	6.3	73	73	73	73	73	40 U	230 U	69.3	40 U	170 U
Subsurface	2,4,6-Trichlorophenol	(ug/kg)	17	1	5.9	57	57	57	57	57	30 U	230 U	69.6	30 U	200 UG
Subsurface	2,4-Dichlorophenol	(ug/kg)	17	1	5.9	140	140	140	140	140	58 U	200 UG	106	100 U	140 U
Subsurface	2,4-Dimethylphenol	(ug/kg)	17	0							19 U	200 U	154	200 UJ	200 U
Subsurface	2,4-Dinitrophenol	(ug/kg)	9	2	22.2	18 J	12000 G	6010	18 J	18 J	18 J	12000 G	1570	300 UG	470 UJ
Subsurface	2-Chlorophenol	(ug/kg)	17	2	11.8	51	93	72	51	51	19 U	93	49.3	50 U	70 UG
Subsurface	2-Methylphenol	(ug/kg)	16	0							19 U	100 U	82.6	100 U	100 U
Subsurface	2-Nitrophenol	(ug/kg)	4	0							97 U	230 U	149	99 U	170 U
Subsurface	4,6-Dinitro-2-methylphenol	(ug/kg)	17	1	5.9	2700 G	2700 G	2700	2700 G	2700 G	100 U	2700 G	301	100 U	470 U
Subsurface	4-Chloro-3-methylphenol	(ug/kg)	17	0							39 U	93 U	54.2	50 U	80 UG
Subsurface	4-Methylphenol	(ug/kg)	4	4	100.0	100	250	153	130	130	100	250	153	130	130
Subsurface	4-Nitrophenol	(ug/kg)	15	0							97 U	400 UG	133	100 U	230 U
Subsurface	Pentachlorophenol	(ug/kg)	9	1	11.1	600 G	600 G	600	600 G	600 G	97 U	600 G	266	300 U	300 U
Subsurface	Phenol	(ug/kg)	17	1	5.9	300	300	300	300	300	19 U	300	60.8	50 UG	60 UG
Subsurface	3- and 4-Methylphenol Coelution	(ug/kg)	6	0							200 U	200 U	200	200 U	200 U
Subsurface	Dimethyl phthalate	(ug/kg)	16	0							10 U	47 U	15.1	10 U	35 U
Subsurface	Diethyl phthalate	(ug/kg)	16	0							10 U	47 U	15.1	10 U	35 U
Subsurface	Dibutyl phthalate	(ug/kg)	16	3	18.8	12 G	1500	511	20	20	10 U	1500	109	10 U	47 U
Subsurface	Butylbenzyl phthalate	(ug/kg)	16	3	18.8	10	42	21.7	13	13	10	47 U	17.3	10 U	42
Subsurface	Di-n-octyl phthalate	(ug/kg)	16	0							10 U	47 U	15.1	10 U	35 U
Subsurface	Bis(2-ethylhexyl) phthalate	(ug/kg)	16	11	68.8	140	4200	835	410 J	1300	20 U	4200	595	280 J	1300
Subsurface	Bis(2-chloro-1-methylethyl) ether	(ug/kg)	16	0							10 U	47 U	15.1	10 U	35 U
Subsurface	2,4-Dinitrotoluene	(ug/kg)	16	0							20 U	230 U	52.3	20 U	170 U
Subsurface	2,6-Dinitrotoluene	(ug/kg)	16	0							10 U	230 U	44.8	10 U	170 U
Subsurface	2-Chloronaphthalene	(ug/kg)	16	0							5 U	47 U	11.3	5 U	35 U

Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
Subsurface	2-Nitroaniline	(ug/kg)	16	0							10 U	230 U	44.8	10 U	170 U
Subsurface	3,3'-Dichlorobenzidine	(ug/kg)	16	0							40 U	230 U	67.3	40 U	170 U
Subsurface	3-Nitroaniline	(ug/kg)	16	0							120 U	280 U	196	200 U	210 U
Subsurface	4-Bromophenyl phenyl ether	(ug/kg)	16	0							10 U	47 U	15.1	10 U	35 U
Subsurface	4-Chloroaniline	(ug/kg)	16	0							50 U	140 U	59.9	50 U	100 U
Subsurface	4-Chlorophenyl phenyl ether	(ug/kg)	16	0							10 U	47 U	15.1	10 U	35 U
Subsurface	4-Nitroaniline	(ug/kg)	16	0							10 U	230 U	44.8	10 U	170 U
Subsurface	Benzoic acid	(ug/kg)	12	4	33.3	430	2600	1200	770	1000	250 U	2600	567	250 U	1000
Subsurface	Benzyl alcohol	(ug/kg)	16	0							19 U	50 U	45.1	50 U	50 U
Subsurface	Bis(2-chloroethoxy) methane	(ug/kg)	16	0							10 U	47 U	15.1	10 U	35 U
Subsurface	Bis(2-chloroethyl) ether	(ug/kg)	16	0							10 U	93 U	22.6	10 U	69 U
Subsurface	Carbazole	(ug/kg)	16	9	56.3	14	500	121	22	390	10 U	500	74.3	18	390
Subsurface	Dibenzofuran	(ug/kg)	16	11	68.8	7 J	630	147	16	360	5 U	630	103	10	360
Subsurface	Hexachlorobenzene	(ug/kg)	16	4	25.0	25	14000	3900	61	1500	10 U	14000	984	10 U	1500
Subsurface	Hexachlorobutadiene	(ug/kg)	18	4	22.2	19	34000	15000	57	26000	10 U	34000	3350	10 U	26000
Subsurface	Hexachlorocyclopentadiene	(ug/kg)	8	0							97 UJ	230 UJ	175	200 U	200 U
Subsurface	Hexachloroethane	(ug/kg)	16	6	37.5	31	20000	3410	95	160	31	20000	1300	40 U	160
Subsurface	Isophorone	(ug/kg)	16	1	6.3	43	43	43	43	43	10 U	47 U	17.1	10 U	43
Subsurface	Nitrobenzene	(ug/kg)	16	0							10 U	47 U	15.1	10 U	35 U
Subsurface	N-Nitrosodipropylamine	(ug/kg)	16	0							10 U	93 U	22.6	10 U	69 U
Subsurface	N-Nitrosodiphenylamine	(ug/kg)	16	0							10 U	47 U	15.1	10 U	35 U
Subsurface	1,1,1,2-Tetrachloroethane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	1,1,1-Trichloroethane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	1,1,2,2-Tetrachloroethane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	1,1,2-Trichloroethane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	1,1-Dichloroethane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Vinylidene chloride	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	1,2,3-Trichloropropane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	1,2-Dichloroethane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	1,2-Dichloropropane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Methyl N-butyl ketone	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	Benzene	(ug/kg)	14	0							5 U	300 U	52.1	9 U	300 U
Subsurface	Bromochloromethane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Bromodichloromethane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Bromoform	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Bromomethane	(ug/kg)	12	0							5 UJ	50 U	10.8	5 UJ	11 U
Subsurface	Carbon disulfide	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Carbon tetrachloride	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Chlorodibromomethane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Chloroethane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Chloroform	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Chloromethane	(ug/kg)	12	0							5 UJ	50 U	10.8	5 U	11 U
Subsurface	cis-1,3-Dichloropropene	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Methylene bromide	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Dichlorodifluoromethane	(ug/kg)	12	0							5 UJ	50 U	10.8	5 UJ	11 U
Subsurface	Ethylbenzene	(ug/kg)	14	0							5 U	300 U	52.1	9 U	300 U
Subsurface	Isopropylbenzene	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	m,p-Xylene	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Methylene chloride	(ug/kg)	12	0							10 U	100 U	21.6	10 U	22 U
Subsurface	o-Xylene	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Styrene	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U

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Table 2. Surface and Subsurface Sediment Chemical Statistics near ATOFINA

Surface or			Number	Number	%	Detected Concentrations					Detected and Nondetected Concentrations				
Subsurface	Analyte	Units	of Samples	Detected	Detected	Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
Subsurface	Tetrachloroethene	(ug/kg)	12	1	8.3	8	8	8	8	8	5 U	50 U	11.1	8	11 U
Subsurface	Toluene	(ug/kg)	14	1	7.1	21	21	21	21	21	5 U	300 U	52.9	9 U	300 U
Subsurface	trans-1,2-Dichloroethene	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	trans-1,3-Dichloropropene	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Trichloroethene	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Trichlorofluoromethane	(ug/kg)	12	0							5 UJ	50 U	10.8	5 UJ	11 U
Subsurface	Vinyl chloride	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	1,1-Dichloropropene	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	1,2-Dibromo-3-chloropropane	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	1,3,5-Trimethylbenzene	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	1,3-Dichloropropane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	2,2-Dichloropropane	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	2-Chlorotoluene	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	4-Chlorotoluene	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	Bromobenzene	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	cis-1,2-Dichloroethene	(ug/kg)	12	0							5 U	50 U	10.8	5 U	11 U
Subsurface	Ethylene dibromide	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	n-Butylbenzene	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	n-Propylbenzene	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	Pseudocumene	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	Sec-butylbenzene	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	tert-Butylbenzene	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	Cymene	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	Xylene	(ug/kg)	2	0							300 U	300 U	300	300 U	300 U
Subsurface	Chlorobenzene	(ug/kg)	12	2	16.7	1900	18000	9950	1900	1900	5 U	18000	1660	5 U	1900
Subsurface	1,2-Dichlorobenzene	(ug/kg)	18	0							5 U	50 U	15.1	10 UG	47 U
Subsurface	1,3-Dichlorobenzene	(ug/kg)	18	0							5 U	50 U	15.1	10 UG	47 U
Subsurface	1,4-Dichlorobenzene	(ug/kg)	18	0							5 U	50 U	15.1	10 UG	47 U
Subsurface	1,2,3-Trichlorobenzene	(ug/kg)	12	0							20 U	200 U	43.3	20 U	45 U
Subsurface	1,2,4-Trichlorobenzene	(ug/kg)	18	4	22.2	12	530	156	40 G	41	10 U	530	50.3	12	47 U

DO NOT QUOTE OR CITE.
This document is currently under review by US EPA.

SUPPLEMENTAL FIGURES

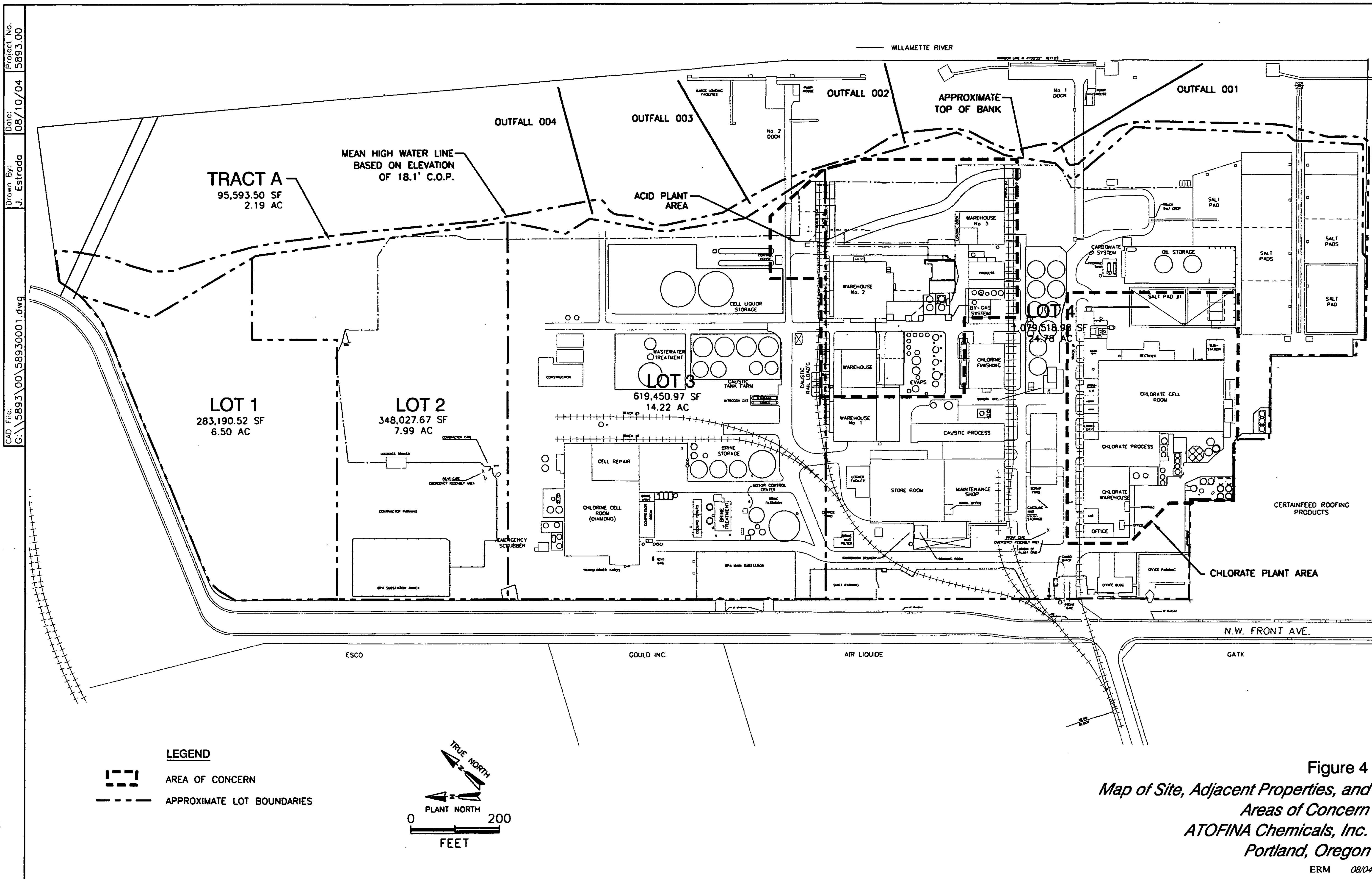

Figure 4
Map of Site, Adjacent Properties, and Areas of Concern
ATOFINA Chemicals, Inc.
Portland, Oregon
ERM 08/04

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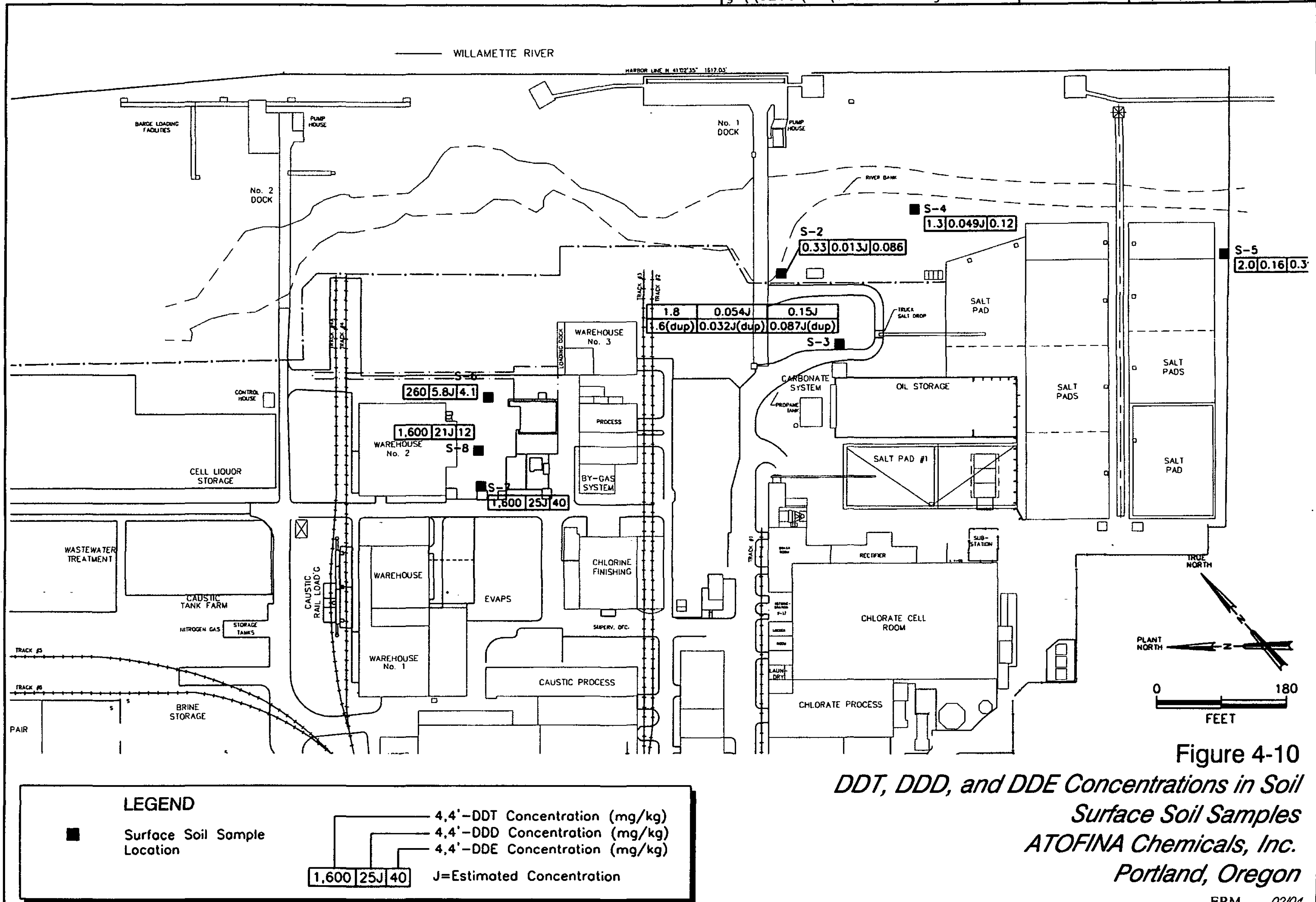

Figure 4-10

DDT, DDD, and DDE Concentrations in Soil Surface Soil Samples

ATOFINA Chemicals, Inc.

Portland, Oregon

ERM 02/04

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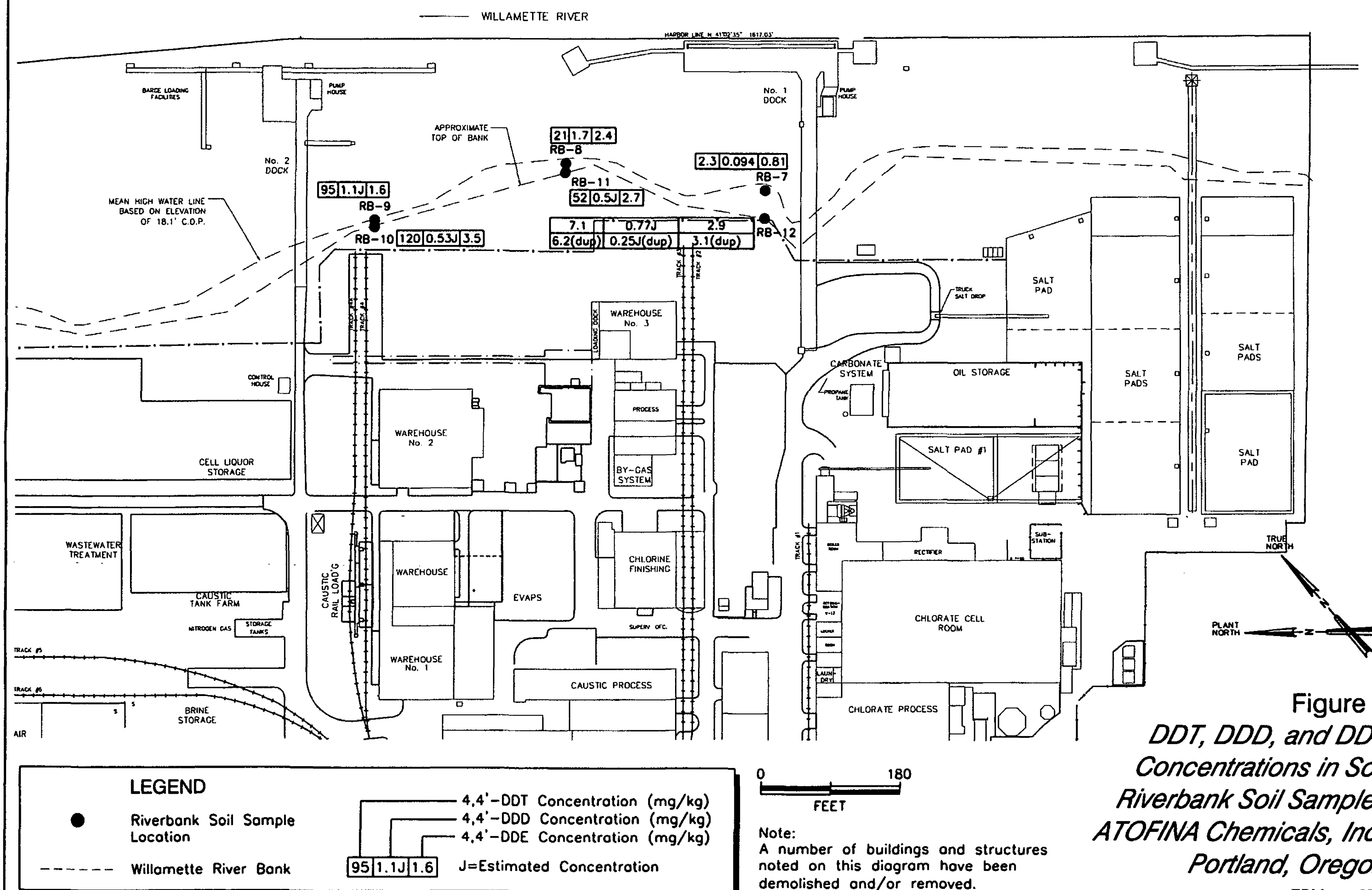

Figure 5
DDT, DDD, and DDE Concentrations in Soil Riverbank Soil Samples
ATOFINA Chemicals, Inc.
Portland, Oregon

ERM 08/04

SUPPLEMENTAL TABLES

Table 3

ATOFINA Chemicals, Inc. - Portland, Oregon

Inorganic Compounds, Natural Attenuation Parameters, and Conventional Analyte Results

June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-2 6/9/2003 GW-060903-01	MWA-3 6/9/2003 GW-060903-04	MWA-4 6/9/2003 GW-060903-07	MWA-5 6/6/2003 GW-060603-06	MWA-6r 6/5/2003 GW-060503-02	MWA-7 6/4/2003 GW-060403-01
Chromium	6020	mg/L	NA	NA	0.00236	NA	0.0189	NA
Iron	6010B	mg/L	11.8	0.100 U	NA	NA	NA	NA
Manganese	6010B	mg/L	1.16	0.189	NA	NA	NA	NA
Chloride	300.0	mg/L	981	107	234	859	1850	175
Nitrate-Nitrogen	300.0	mg/L	1.00 U	2.02	1.00 U	1.00 R	0.18	0.100 U
Nitrite-Nitrogen	300.0	mg/L	1.00 U	0.100 U	1.00 U	1.00 R	10.0 U	0.100 U
Sulfate	300.0	mg/L	490 J	46	299 J	10.0 UJ	110	69.8
Total Alkalinity	310.1	mg/L as CaCO3	43.5	314	500	742	894	378
Methane	RSK 175	µg/L	1.20 U	112	NA	NA	NA	2590
Total Organic Carbon	415.1	mg/L	6.05	3.74	23.8	23.2	16.2	13.8
Perchlorate	314.0	µg/L	1400	92 UF	100 UF	NA	27 UF	NA

Notes: F - Field quality control sample criteria not met

J - Estimated

R - Rejected

U - Undetected at detection limit shown

NA - Not analyzed

NV - Not validated

Table 3
ATOFINA Chemicals, Inc. - Portland, Oregon
Inorganic Compounds, Natural Attenuation Parameters, and Conventional Analyte Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-8i 6/9/2003 GW-060903-02	MWA-9i 6/9/2003 GW-060903-06	MWA-10i 6/10/2003 GW-061003-01	MWA-11i 6/10/2003 GW-061003-03	MWA-12i 6/3/2003 GW-060303-01	MWA-13d 6/9/2003 GW-060903-03
Chromium	6020	mg/L	NA	NA	NA	NA	NA	NA
Iron	6010B	mg/L	NA	NA	NA	NA	NA	NA
Manganese	6010B	mg/L	NA	NA	NA	NA	NA	NA
Chloride	300.0	mg/L	2380	2860	1240	550	14.5	3240
Nitrate-Nitrogen	300.0	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	0.100 UJ	1.00 U
Nitrite-Nitrogen	300.0	mg/L	1.00 U	10.0 U	1.00 U	1.00 U	0.100 UJ	1.00 U
Sulfate	300.0	mg/L	141 J	495 J	242	10.0 U	1.00 U	264 J
Total Alkalinity	310.1	mg/L as CaCO3	1100	650	548	308	445	454
Methane	RSK 175	µg/L	NA	NA	NA	NA	NA	NA
Total Organic Carbon	415.1	mg/L	43.9	49.6	13.7	5.19	5.38	8.86
Perchlorate	314.0	µg/L	20 U	730	260	20 U	NA	20 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed
NV - Not validated

Table 3
ATOFINA Chemicals, Inc. - Portland, Oregon
Inorganic Compounds, Natural Attenuation Parameters, and Conventional Analyte Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-14i 6/6/2003 GW-060603-07	MWA-15r 6/10/2003 GW-061003-04	MWA-16i 6/5/2003 GW-060503-01	MWA-17si 6/9/2003 GW-060903-05	MWA-18 6/6/2003 GW-060603-03	MWA-19 6/6/2003 GW-060603-04
Chromium	6020	mg/L	NA	NA	0.992	NA	NA	NA
Iron	6010B	mg/L	NA	3.43	NA	NA	NA	NA
Manganese	6010B	mg/L	NA	0.0788	NA	NA	NA	NA
Chloride	300.0	mg/L	1720	388	2180	1970	1410	5180
Nitrate-Nitrogen	300.0	mg/L	1 J	10.4	0.100 U	1.6	2.9 J	1.8 J
Nitrite-Nitrogen	300.0	mg/L	1.00 R	1.00 U	10.0 U	10.0 U	1.00 R	10.0 R
Sulfate	300.0	mg/L	105 J	283	73	1900 J	37.4 J	61.2 J
Total Alkalinity	310.1	mg/L as CaCO3	668	865	710	10.0 U	211	243
Methane	RSK 175	µg/L	NA	121	NA	NA	NA	NA
Total Organic Carbon	415.1	mg/L	18.9	50.6	29.7	19.4	4.89	7.05
Perchlorate	314.0	µg/L	NA	350	33 UF	9900	NA	82 UF

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed
NV - Not validated

Table 3
ATOFINA Chemicals, Inc. - Portland, Oregon
Inorganic Compounds, Natural Attenuation Parameters, and Conventional Analyte Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-20 6/5/2003 GW-060503-03	MWA-22 6/10/2003 GW-061003-02	MWA-23 6/4/2003 GW-060403-02	MWA-23 7/29/2003 GW-072903-01	MWA-24 6/5/2003 GW-060503-04	MWA-25 6/6/2003 GW-060603-02
Chromium	6020	mg/L	NA	NA	0.00117	NA	NA	9.79
Iron	6010B	mg/L	NA	NA	12.7	NA	NA	0.100 U
Manganese	6010B	mg/L	NA	NA	4.22	NA	NA	0.173
Chloride	300.0	mg/L	1500	6210	43.4	NA	583	2980
Nitrate-Nitrogen	300.0	mg/L	0.77	1.00 U	0.69	NA	0.100 U	1.00 R
Nitrite-Nitrogen	300.0	mg/L	10.0 U	10.0 U	0.100 U	NA	10.0 U	10.0 R
Sulfate	300.0	mg/L	52.3	1190	154	NA	202	351 J
Total Alkalinity	310.1	mg/L as CaCO3	780	5720	153	NA	7230	986
Methane	RSK 175	µg/L	NA	NA	80.9	NA	NA	2470
Total Organic Carbon	415.1	mg/L	20.8	439	4.59	NA	889	29
Perchlorate	314.0	µg/L	NA	NA	NA	20 U,NV	NA	NA

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed
NV - Not validated

Table 3
ATOFINA Chemicals, Inc. - Portland, Oregon
Inorganic Compounds, Natural Attenuation Parameters, and Conventional Analyte Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-25 7/29/2003 GW-072903-04	MWA-26 6/4/2003 GW-060403-03	MWA-26 7/29/2003 GW-072903-02	MWA-27 6/4/2003 GW-060403-04	MWA-28i 6/6/2003 GW-060603-01	MWA-28i 7/29/2003 GW-072903-03
Chromium	6020	mg/L	NA	1.02	NA	4.3	0.00100 U	NA
Iron	6010B	mg/L	NA	NA	NA	0.100 U	NA	NA
Manganese	6010B	mg/L	NA	NA	NA	0.732	NA	NA
Chloride	300.0	mg/L	NA	632	NA	9360	5.36	NA
Nitrate-Nitrogen	300.0	mg/L	NA	0.65	NA	10.0 U	0.100 R	NA
Nitrite-Nitrogen	300.0	mg/L	NA	0.100 U	NA	10.0 U	0.100 R	NA
Sulfate	300.0	mg/L	NA	73.6	NA	290	1.00 UJ	NA
Total Alkalinity	310.1	mg/L as CaCO3	NA	219	NA	398	295	NA
Methane	RSK 175	µg/L	NA	NA	NA	148	NA	NA
Total Organic Carbon	415.1	mg/L	NA	8.32	NA	14.5	4.01	NA
Perchlorate	314.0	µg/L	290000 NV	NA	1200 NV	210000	NA	20 U,NV

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed
NV - Not validated

Table 3
ATOFINA Chemicals, Inc. - Portland, Oregon
Inorganic Compounds, Natural Attenuation Parameters, and Conventional Analyte Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-29 6/4/2003 GW-060403-06	MWA-30 6/4/2003 GW-060403-08	MWA-31i 6/4/2003 GW-060403-07	MWA-32ia 6/4/2003 GW-060403-10	MWA-33 6/11/2003 GW-061103-02	MWA-33 6/11/2003 GW-061103-03
Chromium	6020	mg/L	0.0284	0.562	1.15	0.238	0.226	0.601
Iron	6010B	mg/L	NA	0.264	NA	NA	5.59	9.99
Manganese	6010B	mg/L	NA	1.19	NA	NA	0.142	0.219
Chloride	300.0	mg/L	11700	164000	61100	31000	286	210
Nitrate-Nitrogen	300.0	mg/L	10.0 U	100 U	100 U	100 U	1.00 U	1.00 U
Nitrite-Nitrogen	300.0	mg/L	10.0 U	100 U	100 U	100 U	1.00 U	1.00 U
Sulfate	300.0	mg/L	291	1530	381	399	156	167
Total Alkalinity	310.1	mg/L as CaCO3	212	78.8	147	286	1110	1190
Methane	RSK 175	µg/L	NA	2.18 J	NA	NA	4900	6450
Total Organic Carbon	415.1	mg/L	7.53	1.00 U	1.00 U	15.7	17.5	40.7
Perchlorate	314.0	µg/L	110 UF	7900	4700	200000	320	840

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed
NV - Not validated

Table 3

ATOFINA Chemicals, Inc. - Portland, Oregon

Inorganic Compounds, Natural Attenuation Parameters, and Conventional Analyte Results

June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-33a 6/5/2003 GW-060503-05	MWA-33 (Dup) 6/5/2003 GW-060503-06	MWA-34ia 6/6/2003 GW-060603-05	NMP-3D 6/11/2003 GW-061103-01	NMP-4D 6/10/2003 GW-061003-06	NMP-4D (Dup) 6/10/2003 GW-061003-07
Chromium	6020	mg/L	0.532	0.514	0.142	NA	NA	NA
Iron	6010B	mg/L	2.27	NA	NA	1.04	3.71	3.49
Manganese	6010B	mg/L	0.068	NA	NA	0.781	0.473	0.559
Chloride	300.0	mg/L	198	208	3040	2260	2180	2150
Nitrate-Nitrogen	300.0	mg/L	3.42 J	0.100 UJ	1.00 R	3	1.00 U	1.00 U
Nitrite-Nitrogen	300.0	mg/L	0.100 UJ	0.100 UJ	1.00 R	1.00 U	1.00 U	1.00 U
Sulfate	300.0	mg/L	177	196	80.3 J	2900	3470	3500
Total Alkalinity	310.1	mg/L as CaCO3	1200	1210	1950	50.0 U	25.4	22.5
Methane	RSK 175	µg/L	NA	NA	NA	1440	1030	1060
Total Organic Carbon	415.1	mg/L	22.9	22.3	34.5	28.8	37.6	39.9
Perchlorate	314.0	µg/L	540	570	4600	NA	NA	NA

Notes: F - Field quality control sample criteria not met

J - Estimated

R - Rejected

U - Undetected at detection limit shown

NA - Not analyzed

NV - Not validated

Table 3
ATOFINA Chemicals, Inc. - Portland, Oregon
Inorganic Compounds, Natural Attenuation Parameters, and Conventional Analyte Results
June 2003 Groundwater Sampling

Analyte	Method	Units	Rinsate 6/4/2003 GW-060403-05	Rinsate 6/9/2003 GW-060903-08	Rinsate 6/10/2003 GW-061003-05	Trip Blank 6/3/2003 Trip Blank-01	Trip Blank 6/10/2003 Trip Blank-05
Chromium	6020	mg/L	0.00100 U	0.00100 U	NA	NA	NA
Iron	6010B	mg/L	NA	NA	NA	NA	NA
Manganese	6010B	mg/L	NA	NA	NA	NA	NA
Chloride	300.0	mg/L	NA	NA	NA	NA	NA
Nitrate-Nitrogen	300.0	mg/L	NA	NA	NA	NA	NA
Nitrite-Nitrogen	300.0	mg/L	NA	NA	NA	NA	NA
Sulfate	300.0	mg/L	NA	NA	NA	NA	NA
Total Alkalinity	310.1	mg/L as CaCO3	NA	NA	NA	NA	NA
Methane	RSK 175	µg/L	NA	NA	NA	1.20 U	1.20 U
Total Organic Carbon	415.1	mg/L	NA	NA	1.20 U	NA	NA
Perchlorate	314.0	µg/L	31	NA	20 U	NA	NA

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed
NV - Not validated

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-2 6/9/2003 GW-060903-01	MWA-3 6/9/2003 GW-060903-04	MWA-4 6/9/2003 GW-060903-07	MWA-5 6/6/2003 GW-060603-06
1,1,1,2-Tetrachloroethane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
1,1,1-Trichloroethane	8260B	µg/L	50.0 U	0.53	2.50 U	0.500 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
1,1,2-Trichloroethane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
1,1-Dichloroethane	8260B	µg/L	50.0 U	1.62	2.50 U	2.61
1,1-Dichloroethene	8260B	µg/L	50.0 U	0.500 U	2.50 U	1.39
1,1-Dichloropropene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
1,2,3-Trichlorobenzene	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
1,2,3-Trichloropropane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
1,2,4-Trichlorobenzene	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
1,2,4-Trimethylbenzene	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	200 U	2.00 U	10.0 U	2.00 U
1,2-Dibromoethane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
1,2-Dichlorobenzene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
1,2-Dichloroethane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
1,2-Dichloropropane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
1,3,5-Trimethylbenzene	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
1,3-Dichlorobenzene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
1,3-Dichloropropane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
1,4-Dichlorobenzene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
2,2-Dichloropropane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
2-Butanone	8260B	µg/L	1000 U	10.0 U	50.0 U	10.0 U
2-Chlorotoluene	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
2-Hexanone	8260B	µg/L	1000 U	10.0 U	50.0 U	10.0 U
4-Chlorotoluene	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
4-Methyl-2-pentanone	8260B	µg/L	500 U	5.00 U	25.0 U	5.00 U
Acetone	8260B	µg/L	2000 U	20.0 U	100 U	20.0 U
Benzene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Bromobenzene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Bromochloromethane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Bromodichloromethane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Bromoform	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Bromomethane	8260B	µg/L	200 U	2.00 U	10.0 U	2.00 U
Carbon disulfide	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
Carbon tetrachloride	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Chlorobenzene	8260B	µg/L	13700	176	646	23.1
Chloroethane	8260B	µg/L	50.0 U	0.74	2.50 U	1.62
Chloroform	8260B	µg/L	144 U	7.65 U	4.55 U	0.500 U
Chloromethane	8260B	µg/L	200 U	2.00 U	10.0 U	2.00 U
cis-1,2-Dichloroethene	8260B	µg/L	50.0 U	4.45	2.50 U	0.500 U
cis-1,3-Dichloropropene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Dibromochloromethane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Dibromomethane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Dichlorodifluoromethane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-2 6/9/2003 GW-060903-01	MWA-3 6/9/2003 GW-060903-04	MWA-4 6/9/2003 GW-060903-07	MWA-5 6/6/2003 GW-060603-06
Ethylbenzene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Hexachlorobutadiene	8260B	µg/L	200 U	2.00 U	10.0 U	2.00 U
Isopropylbenzene	8260B	µg/L	200 U	2.00 U	10.0 U	2.00 U
m,p-Xylene	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
Methyl tert-butyl ether	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
Methylene chloride	8260B	µg/L	500 U	5.00 U	25.0 U	5.00 U
Naphthalene	8260B	µg/L	200 U	2.00 U	10.0 U	2.00 U
n-Butylbenzene	8260B	µg/L	500 U	5.00 U	25.0 U	5.00 U
n-Propylbenzene	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
o-Xylene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
p-Isopropyltoluene	8260B	µg/L	200 U	2.00 U	10.0 U	2.00 U
sec-Butylbenzene	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
Styrene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
tert-Butylbenzene	8260B	µg/L	100 U	1.00 U	5.00 U	1.00 U
Tetrachloroethene	8260B	µg/L	50.0 U	14.7	2.75	0.500 U
Toluene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
trans-1,2-Dichloroethene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
trans-1,3-Dichloropropene	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Trichloroethene	8260B	µg/L	50.0 U	5.54	2.50 U	0.500 U
Trichlorofluoromethane	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U
Vinyl chloride	8260B	µg/L	50.0 U	0.500 U	2.50 U	0.500 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-6r 6/5/2003 GW-060503-02	MWA-7 6/4/2003 GW-060403-01	MWA-8i 6/9/2003 GW-060903-02	MWA-9i 6/9/2003 GW-060903-06
1,1,1,2-Tetrachloroethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,1,1-Trichloroethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,1,2-Trichloroethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,1-Dichloroethane	8260B	µg/L	10.0 U	0.500 U	1	100 U
1,1-Dichloroethene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,1-Dichloropropene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,2,3-Trichlorobenzene	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
1,2,3-Trichloropropane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,2,4-Trichlorobenzene	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
1,2,4-Trimethylbenzene	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	40.0 U	2.00 U	2.00 U	400 U
1,2-Dibromoethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,2-Dichlorobenzene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,2-Dichloroethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,2-Dichloropropane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,3,5-Trimethylbenzene	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
1,3-Dichlorobenzene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,3-Dichloropropane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
1,4-Dichlorobenzene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
2,2-Dichloropropane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
2-Butanone	8260B	µg/L	200 U	10.0 U	10.0 U	2000 U
2-Chlorotoluene	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
2-Hexanone	8260B	µg/L	200 U	10.0 U	10.0 U	2000 U
4-Chlorotoluene	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
4-Methyl-2-pentanone	8260B	µg/L	100 U	5.00 U	5.00 U	1000 U
Acetone	8260B	µg/L	400 U	20.0 R	20.0 U	4000 U
Benzene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Bromobenzene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Bromochloromethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Bromodichloromethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Bromoform	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Bromomethane	8260B	µg/L	40.0 U	2.00 U	2.00 U	400 U
Carbon disulfide	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
Carbon tetrachloride	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Chlorobenzene	8260B	µg/L	2620	0.500 U	22.7	32100
Chloroethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Chloroform	8260B	µg/L	14.2 U	0.500 U	0.500 U	100 U
Chloromethane	8260B	µg/L	40.0 U	2.00 U	2.00 U	400 U
cis-1,2-Dichloroethene	8260B	µg/L	67.2	0.500 U	0.500 U	100 U
cis-1,3-Dichloropropene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Dibromochloromethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Dibromomethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Dichlorodifluoromethane	8260B	µg/L	10.0 U	0.500 UJ	0.500 U	100 U

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-6r 6/5/2003 GW-060503-02	MWA-7 6/4/2003 GW-060403-01	MWA-8i 6/9/2003 GW-060903-02	MWA-9i 6/9/2003 GW-060903-06
Ethylbenzene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Hexachlorobutadiene	8260B	µg/L	40.0 U	2.00 U	2.00 U	400 U
Isopropylbenzene	8260B	µg/L	40.0 U	2.00 U	2.00 U	400 U
m,p-Xylene	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
Methyl tert-butyl ether	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
Methylene chloride	8260B	µg/L	100 U	5.00 U	5.00 U	1000 U
Naphthalene	8260B	µg/L	40.0 U	2.00 U	2.00 U	400 U
n-Butylbenzene	8260B	µg/L	100 U	5.00 U	5.00 U	1000 U
n-Propylbenzene	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
o-Xylene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
p-Isopropyltoluene	8260B	µg/L	40.0 U	2.00 U	2.00 U	400 U
sec-Butylbenzene	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
Styrene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
tert-Butylbenzene	8260B	µg/L	20.0 U	1.00 U	1.00 U	200 U
Tetrachloroethene	8260B	µg/L	223	0.500 U	0.500 U	100 U
Toluene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
trans-1,2-Dichloroethene	8260B	µg/L	12.6	0.500 U	0.500 U	100 U
trans-1,3-Dichloropropene	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Trichloroethene	8260B	µg/L	38.8	0.500 U	0.500 U	100 U
Trichlorofluoromethane	8260B	µg/L	10.0 U	0.500 U	0.500 U	100 U
Vinyl chloride	8260B	µg/L	28.4	0.500 U	0.500 U	100 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-10i 6/10/2003 GW-061003-01	MWA-11i 6/10/2003 GW-061003-03	MWA-12i 6/3/2003 GW-060303-01	MWA-13d 6/9/2003 GW-060903-03
1,1,1,2-Tetrachloroethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,1,1-Trichloroethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,1,2-Trichloroethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,1-Dichloroethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.68
1,1-Dichloroethene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,1-Dichloropropene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,2,3-Trichlorobenzene	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
1,2,3-Trichloropropane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,2,4-Trichlorobenzene	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
1,2,4-Trimethylbenzene	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	200 U	2.00 U	2.00 U	2.00 U
1,2-Dibromoethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,2-Dichlorobenzene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,2-Dichloroethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,2-Dichloropropane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,3,5-Trimethylbenzene	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
1,3-Dichlorobenzene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,3-Dichloropropane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
1,4-Dichlorobenzene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
2,2-Dichloropropane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
2-Butanone	8260B	µg/L	1000 U	10.0 U	10.0 U	10.0 U
2-Chlorotoluene	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
2-Hexanone	8260B	µg/L	1000 U	10.0 U	10.0 U	10.0 U
4-Chlorotoluene	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
4-Methyl-2-pentanone	8260B	µg/L	500 U	5.00 U	5.00 U	5.00 U
Acetone	8260B	µg/L	2000 U	20.0 U	20.0 R	20.0 U
Benzene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Bromobenzene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Bromochloromethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Bromodichloromethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Bromoform	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Bromomethane	8260B	µg/L	200 U	2.00 U	2.00 U	2.00 U
Carbon disulfide	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
Carbon tetrachloride	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Chlorobenzene	8260B	µg/L	15800	0.71 U	0.500 U	10.6
Chloroethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Chloroform	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Chloromethane	8260B	µg/L	200 U	2.00 U	2.00 U	2.00 U
cis-1,2-Dichloroethene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
cis-1,3-Dichloropropene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Dibromochloromethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Dibromomethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Dichlorodifluoromethane	8260B	µg/L	50.0 U	0.500 U	0.500 UJ	0.500 U

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-10i 6/10/2003 GW-061003-01	MWA-11i 6/10/2003 GW-061003-03	MWA-12i 6/3/2003 GW-060303-01	MWA-13d 6/9/2003 GW-060903-03
Ethylbenzene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Hexachlorobutadiene	8260B	µg/L	200 U	2.00 U	2.00 U	2.00 U
Isopropylbenzene	8260B	µg/L	200 U	2.00 U	2.00 U	2.00 U
m,p-Xylene	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
Methyl tert-butyl ether	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
Methylene chloride	8260B	µg/L	500 U	5.00 U	5.00 U	5.00 U
Naphthalene	8260B	µg/L	200 U	2.00 U	2.00 U	2.00 U
n-Butylbenzene	8260B	µg/L	500 U	5.00 U	5.00 U	5.00 U
n-Propylbenzene	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
o-Xylene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
p-Isopropyltoluene	8260B	µg/L	200 U	2.00 U	2.00 U	2.00 U
sec-Butylbenzene	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
Styrene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
tert-Butylbenzene	8260B	µg/L	100 U	1.00 U	1.00 U	1.00 U
Tetrachloroethene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Toluene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
trans-1,2-Dichloroethene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
trans-1,3-Dichloropropene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Trichloroethene	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Trichlorofluoromethane	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U
Vinyl chloride	8260B	µg/L	50.0 U	0.500 U	0.500 U	0.500 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-14i 6/6/2003 GW-060603-07	MWA-15r 6/10/2003 GW-061003-04	MWA-16i 6/5/2003 GW-060503-01	MWA-17si 6/9/2003 GW-060903-05
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,1,1-Trichloroethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,1,2-Trichloroethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,1-Dichloroethane	8260B	µg/L	1.7	50.0 U	0.82	500 U
1,1-Dichloroethene	8260B	µg/L	1.25	50.0 U	0.500 U	500 U
1,1-Dichloropropene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
1,2,3-Trichloropropane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.00 U	200 U	2.00 U	2000 U
1,2-Dibromoethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,2-Dichlorobenzene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,2-Dichloroethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,2-Dichloropropane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
1,3-Dichlorobenzene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,3-Dichloropropane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
1,4-Dichlorobenzene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
2,2-Dichloropropane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
2-Butanone	8260B	µg/L	10.0 U	1000 U	10.0 U	10000 U
2-Chlorotoluene	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
2-Hexanone	8260B	µg/L	10.0 U	1000 U	10.0 U	10000 U
4-Chlorotoluene	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
4-Methyl-2-pentanone	8260B	µg/L	5.00 U	500 U	5.00 U	5000 U
Acetone	8260B	µg/L	20.0 U	2000 U	20.0 U	20000 U
Benzene	8260B	µg/L	0.500 U	50.0 U	0.87	500 U
Bromobenzene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Bromochloromethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Bromodichloromethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Bromoform	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Bromomethane	8260B	µg/L	2.00 U	200 U	2.00 U	2000 U
Carbon disulfide	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
Carbon tetrachloride	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Chlorobenzene	8260B	µg/L	0.5 U	13300	17.5	73200
Chloroethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Chloroform	8260B	µg/L	0.500 U	219 U	0.71 U	550 U
Chloromethane	8260B	µg/L	2.00 U	200 U	2.00 U	2000 U
cis-1,2-Dichloroethene	8260B	µg/L	0.500 U	50.0 U	0.51	500 U
cis-1,3-Dichloropropene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Dibromochloromethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Dibromomethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Dichlorodifluoromethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-14i 6/6/2003 GW-060603-07	MWA-15r 6/10/2003 GW-061003-04	MWA-16i 6/5/2003 GW-060503-01	MWA-17si 6/9/2003 GW-060903-05
Ethylbenzene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Hexachlorobutadiene	8260B	µg/L	2.00 U	200 U	2.00 U	2000 U
Isopropylbenzene	8260B	µg/L	2.00 U	200 U	2.00 U	2000 U
m,p-Xylene	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
Methyl tert-butyl ether	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
Methylene chloride	8260B	µg/L	5.00 U	500 U	5.00 U	5000 U
Naphthalene	8260B	µg/L	2.00 U	200 U	2.00 U	2000 U
n-Butylbenzene	8260B	µg/L	5.00 U	500 U	5.00 U	5000 U
n-Propylbenzene	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
o-Xylene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
p-Isopropyltoluene	8260B	µg/L	2.00 U	200 U	2.00 U	2000 U
sec-Butylbenzene	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
Styrene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
tert-Butylbenzene	8260B	µg/L	1.00 U	100 U	1.00 U	1000 U
Tetrachloroethene	8260B	µg/L	0.500 U	50.0 U	5.78	500 U
Toluene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
trans-1,2-Dichloroethene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
trans-1,3-Dichloropropene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Trichloroethene	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Trichlorofluoromethane	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U
Vinyl chloride	8260B	µg/L	0.500 U	50.0 U	0.500 U	500 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-18 6/6/2003 GW-060603-03	MWA-19 6/6/2003 GW-060603-04	MWA-20 6/5/2003 GW-060503-03	MWA-22 6/10/2003 GW-061003-02
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,1,1-Trichloroethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,1,2-Trichloroethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,1-Dichloroethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,1-Dichloroethene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,1-Dichloropropene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
1,2,3-Trichloropropane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.00 U	2.00 U	4.00 U	4.00 U
1,2-Dibromoethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,2-Dichlorobenzene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,2-Dichloroethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,2-Dichloropropane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
1,3-Dichlorobenzene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,3-Dichloropropane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
1,4-Dichlorobenzene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
2,2-Dichloropropane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
2-Butanone	8260B	µg/L	10.0 U	10.0 U	20.0 U	20.0 U
2-Chlorotoluene	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
2-Hexanone	8260B	µg/L	10.0 U	10.0 U	20.0 U	20.0 U
4-Chlorotoluene	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
4-Methyl-2-pentanone	8260B	µg/L	5.00 U	5.00 U	10.0 U	10.0 U
Acetone	8260B	µg/L	20.0 U	20.0 U	40.0 U	40.0 U
Benzene	8260B	µg/L	0.500 U	0.500 U	3.32	1.00 U
Bromobenzene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Bromochloromethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Bromodichloromethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Bromoform	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Bromomethane	8260B	µg/L	2.00 U	2.00 U	4.00 U	4.00 U
Carbon disulfide	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
Carbon tetrachloride	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Chlorobenzene	8260B	µg/L	3.06 U	0.64 U	215	128
Chloroethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Chloroform	8260B	µg/L	11.7 U	1.8 U	1.00 U	1.00 U
Chloromethane	8260B	µg/L	2.00 U	2.00 U	4.00 U	4.00 U
cis-1,2-Dichloroethene	8260B	µg/L	0.500 U	0.500 U	1.00 U	25.5
cis-1,3-Dichloropropene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Dibromochloromethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Dibromomethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Dichlorodifluoromethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-18 6/6/2003 GW-060603-03	MWA-19 6/6/2003 GW-060603-04	MWA-20 6/5/2003 GW-060503-03	MWA-22 6/10/2003 GW-061003-02
Ethylbenzene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Hexachlorobutadiene	8260B	µg/L	2.00 U	2.00 U	4.00 U	4.00 U
Isopropylbenzene	8260B	µg/L	2.00 U	2.00 U	4.00 U	4.00 U
m,p-Xylene	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
Methyl tert-butyl ether	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
Methylene chloride	8260B	µg/L	5.00 U	5.00 U	10.0 U	10.0 U
Naphthalene	8260B	µg/L	2.00 U	2.00 U	4.00 U	4.00 U
n-Butylbenzene	8260B	µg/L	5.00 U	5.00 U	10.0 U	10.0 U
n-Propylbenzene	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
o-Xylene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
p-Isopropyltoluene	8260B	µg/L	2.00 U	2.00 U	4.00 U	4.00 U
sec-Butylbenzene	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
Styrene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
tert-Butylbenzene	8260B	µg/L	1.00 U	1.00 U	2.00 U	2.00 U
Tetrachloroethene	8260B	µg/L	22	64	1.00 U	1.00 U
Toluene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
trans-1,2-Dichloroethene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
trans-1,3-Dichloropropene	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Trichloroethene	8260B	µg/L	2.2	9.25	1.00 U	1.00 U
Trichlorofluoromethane	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.00 U
Vinyl chloride	8260B	µg/L	0.500 U	0.500 U	1.00 U	1.36

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-33a 6/5/2003 GW-060503-05	MWA-34ia 6/6/2003 GW-060603-05	NMP-3D 6/11/2003 GW-061103-01	NMP-4D 6/10/2003 GW-061003-06
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,1,1-Trichloroethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,1,2-Trichloroethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,1-Dichloroethane	8260B	µg/L	1.04	2.50 U	500 U	500 U
1,1-Dichloroethene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,1-Dichloropropene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
1,2,3-Trichloropropane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.00 U	10.0 U	2000 U	2000 U
1,2-Dibromoethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,2-Dichlorobenzene	8260B	µg/L	2.13	2.50 U	500 U	500 U
1,2-Dichloroethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,2-Dichloropropane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
1,3-Dichlorobenzene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,3-Dichloropropane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
1,4-Dichlorobenzene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
2,2-Dichloropropane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
2-Butanone	8260B	µg/L	10.0 U	50.0 U	10000 U	10000 U
2-Chlorotoluene	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
2-Hexanone	8260B	µg/L	10.0 U	50.0 U	10000 U	10000 U
4-Chlorotoluene	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
4-Methyl-2-pentanone	8260B	µg/L	5.00 U	25.0 U	5000 U	5000 U
Acetone	8260B	µg/L	20.0 U	100 U	20000 U	20000 U
Benzene	8260B	µg/L	1.35	2.6	500 U	500 U
Bromobenzene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Bromochloromethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Bromodichloromethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Bromoform	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Bromomethane	8260B	µg/L	2.00 U	10.0 U	2000 U	2000 U
Carbon disulfide	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
Carbon tetrachloride	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Chlorobenzene	8260B	µg/L	2.51 U	666	127000	185000
Chloroethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Chloroform	8260B	µg/L	0.8 U	10.2 U	510 U	1250 U
Chloromethane	8260B	µg/L	2.00 U	10.0 U	2000 U	2000 U
cis-1,2-Dichloroethene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
cis-1,3-Dichloropropene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Dibromochloromethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Dibromomethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Dichlorodifluoromethane	8260B	µg/L	0.500 U	2.50 U	500 UJ	500 UJ

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-33a 6/5/2003 GW-060503-05	MWA-34ia 6/6/2003 GW-060603-05	NMP-3D 6/11/2003 GW-061103-01	NMP-4D 6/10/2003 GW-061003-06
Ethylbenzene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Hexachlorobutadiene	8260B	µg/L	2.00 U	10.0 U	2000 U	2000 U
Isopropylbenzene	8260B	µg/L	2.00 U	10.0 U	2000 U	2000 U
m,p-Xylene	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
Methyl tert-butyl ether	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
Methylene chloride	8260B	µg/L	5.00 U	25.0 U	5000 U	5000 U
Naphthalene	8260B	µg/L	2.00 U	10.0 U	2000 U	2000 U
n-Butylbenzene	8260B	µg/L	5.00 U	25.0 U	5000 U	5000 U
n-Propylbenzene	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
o-Xylene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
p-Isopropyltoluene	8260B	µg/L	2.00 U	10.0 U	2000 U	2000 U
sec-Butylbenzene	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
Styrene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
tert-Butylbenzene	8260B	µg/L	1.00 U	5.00 U	1000 U	1000 U
Tetrachloroethene	8260B	µg/L	0.500 U	3.3	500 U	500 U
Toluene	8260B	µg/L	0.91	2.50 U	500 U	500 U
trans-1,2-Dichloroethene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
trans-1,3-Dichloropropene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Trichloroethene	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Trichlorofluoromethane	8260B	µg/L	0.500 U	2.50 U	500 U	500 U
Vinyl chloride	8260B	µg/L	0.500 U	2.50 U	500 U	500 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	NMP-4D(Dup) 6/10/2003 GW-061003-07	Rinsate 6/10/2003 GW-061003-05	Trip Blank 6/3/2003 Trip Blank-01	Trip Blank 6/5/2003 Trip Blank-02
1,1,1,2-Tetrachloroethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,1,1-Trichloroethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,1,2-Trichloroethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,1-Dichloroethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,1-Dichloroethene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,1-Dichloropropene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,2,3-Trichlorobenzene	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
1,2,3-Trichloropropane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,2,4-Trichlorobenzene	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
1,2,4-Trimethylbenzene	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2000 U	2.00 U	2.00 U	2.00 U
1,2-Dibromoethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,2-Dichlorobenzene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,2-Dichloroethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,2-Dichloropropane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,3,5-Trimethylbenzene	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
1,3-Dichlorobenzene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,3-Dichloropropane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
1,4-Dichlorobenzene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
2,2-Dichloropropane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
2-Butanone	8260B	µg/L	10000 U	10.0 U	10.0 U	10.0 U
2-Chlorotoluene	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
2-Hexanone	8260B	µg/L	10000 U	10.0 U	10.0 U	10.0 U
4-Chlorotoluene	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
4-Methyl-2-pentanone	8260B	µg/L	5000 U	5.00 U	5.00 U	5.00 U
Acetone	8260B	µg/L	20000 U	20.0 U	20.0 R	20.0 U
Benzene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Bromobenzene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Bromochloromethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Bromodichloromethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Bromoform	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Bromomethane	8260B	µg/L	2000 U	2.00 U	2.00 U	2.00 U
Carbon disulfide	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
Carbon tetrachloride	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Chlorobenzene	8260B	µg/L	146000	0.71	0.500 U	0.500 U
Chloroethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Chloroform	8260B	µg/L	1130 U	2.5	0.500 U	0.500 U
Chloromethane	8260B	µg/L	2000 U	2.00 U	2.00 U	2.00 U
cis-1,2-Dichloroethene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
cis-1,3-Dichloropropene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Dibromochloromethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Dibromomethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Dichlorodifluoromethane	8260B	µg/L	500 UJ	0.500 U	0.500 UJ	0.500 U

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	NMP-4D(Dup) 6/10/2003 GW-061003-07	Rinsate 6/10/2003 GW-061003-05	Trip Blank 6/3/2003 Trip Blank-01	Trip Blank 6/5/2003 Trip Blank-02
Ethylbenzene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Hexachlorobutadiene	8260B	µg/L	2000 U	2.00 U	2.00 U	2.00 U
Isopropylbenzene	8260B	µg/L	2000 U	2.00 U	2.00 U	2.00 U
m,p-Xylene	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
Methyl tert-butyl ether	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
Methylene chloride	8260B	µg/L	5000 U	5.00 U	5.00 U	5.00 U
Naphthalene	8260B	µg/L	2000 U	2.00 U	2.00 U	2.00 U
n-Butylbenzene	8260B	µg/L	5000 U	5.00 U	5.00 U	5.00 U
n-Propylbenzene	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
o-Xylene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
p-Isopropyltoluene	8260B	µg/L	2000 U	2.00 U	2.00 U	2.00 U
sec-Butylbenzene	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
Styrene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
tert-Butylbenzene	8260B	µg/L	1000 U	1.00 U	1.00 U	1.00 U
Tetrachloroethene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Toluene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
trans-1,2-Dichloroethene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
trans-1,3-Dichloropropene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Trichloroethene	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Trichlorofluoromethane	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U
Vinyl chloride	8260B	µg/L	500 U	0.500 U	0.500 U	0.500 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	Trip Blank 6/10/2003 Trip Blank-05	Trip Blank 6/10/2003 Trip Blank-09
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.500 U	0.500 U
1,1,1-Trichloroethane	8260B	µg/L	0.500 U	0.500 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.500 U	0.500 U
1,1,2-Trichloroethane	8260B	µg/L	0.500 U	0.500 U
1,1-Dichloroethane	8260B	µg/L	0.500 U	0.500 U
1,1-Dichloroethene	8260B	µg/L	0.500 U	0.500 U
1,1-Dichloropropene	8260B	µg/L	0.500 U	0.500 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.00 U	1.00 U
1,2,3-Trichloropropane	8260B	µg/L	0.500 U	0.500 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.00 U	1.00 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.00 U	1.00 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.00 U	2.00 U
1,2-Dibromoethane	8260B	µg/L	0.500 U	0.500 U
1,2-Dichlorobenzene	8260B	µg/L	0.500 U	0.500 U
1,2-Dichloroethane	8260B	µg/L	0.500 U	0.500 U
1,2-Dichloropropane	8260B	µg/L	0.500 U	0.500 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.00 U	1.00 U
1,3-Dichlorobenzene	8260B	µg/L	0.500 U	0.500 U
1,3-Dichloropropane	8260B	µg/L	0.500 U	0.500 U
1,4-Dichlorobenzene	8260B	µg/L	0.500 U	0.500 U
2,2-Dichloropropane	8260B	µg/L	0.500 UJ	0.500 U
2-Butanone	8260B	µg/L	10.0 U	10.0 U
2-Chlorotoluene	8260B	µg/L	1.00 U	1.00 U
2-Hexanone	8260B	µg/L	10.0 U	10.0 U
4-Chlorotoluene	8260B	µg/L	1.00 U	1.00 U
4-Methyl-2-pentanone	8260B	µg/L	5.00 U	5.00 U
Acetone	8260B	µg/L	20.0 U	20.0 U
Benzene	8260B	µg/L	0.500 U	0.500 U
Bromobenzene	8260B	µg/L	0.500 U	0.500 U
Bromochloromethane	8260B	µg/L	0.500 U	0.500 U
Bromodichloromethane	8260B	µg/L	0.500 U	0.500 U
Bromoform	8260B	µg/L	0.500 U	0.500 U
Bromomethane	8260B	µg/L	2.00 U	2.00 U
Carbon disulfide	8260B	µg/L	1.00 U	1.00 U
Carbon tetrachloride	8260B	µg/L	0.500 U	0.500 U
Chlorobenzene	8260B	µg/L	0.500 U	0.500 U
Chloroethane	8260B	µg/L	0.500 U	0.500 U
Chloroform	8260B	µg/L	0.500 U	0.500 U
Chloromethane	8260B	µg/L	2.00 U	2.00 U
cis-1,2-Dichloroethene	8260B	µg/L	0.500 U	0.500 U
cis-1,3-Dichloropropene	8260B	µg/L	0.500 U	0.500 U
Dibromochloromethane	8260B	µg/L	0.500 U	0.500 U
Dibromomethane	8260B	µg/L	0.500 U	0.500 U
Dichlorodifluoromethane	8260B	µg/L	0.500 U	0.500 U

Table 4
ATOFINA Chemicals, Inc. - Portland, Oregon
Volatile Organic Compound Results
June 2003 Groundwater Sampling

Analyte	Method	Units	Trip Blank 6/10/2003 Trip Blank-05	Trip Blank 6/10/2003 Trip Blank-09
Ethylbenzene	8260B	µg/L	0.500 U	0.500 U
Hexachlorobutadiene	8260B	µg/L	2.00 U	2.00 U
Isopropylbenzene	8260B	µg/L	2.00 U	2.00 U
m,p-Xylene	8260B	µg/L	1.00 U	1.00 U
Methyl tert-butyl ether	8260B	µg/L	1.00 U	1.00 U
Methylene chloride	8260B	µg/L	5.00 U	5.00 U
Naphthalene	8260B	µg/L	2.00 U	2.00 U
n-Butylbenzene	8260B	µg/L	5.00 U	5.00 U
n-Propylbenzene	8260B	µg/L	1.00 U	1.00 U
o-Xylene	8260B	µg/L	0.500 U	0.500 U
p-Isopropyltoluene	8260B	µg/L	2.00 U	2.00 U
sec-Butylbenzene	8260B	µg/L	1.00 U	1.00 U
Styrene	8260B	µg/L	0.500 U	0.500 U
tert-Butylbenzene	8260B	µg/L	1.00 U	1.00 U
Tetrachloroethene	8260B	µg/L	0.500 U	0.500 U
Toluene	8260B	µg/L	0.500 U	0.500 U
trans-1,2-Dichloroethene	8260B	µg/L	0.500 U	0.500 U
trans-1,3-Dichloropropene	8260B	µg/L	0.500 UJ	0.500 U
Trichloroethene	8260B	µg/L	0.500 U	0.500 U
Trichlorofluoromethane	8260B	µg/L	0.500 U	0.500 U
Vinyl chloride	8260B	µg/L	0.500 U	0.500 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 5

ATOFINA Chemicals, Inc. - Portland, Oregon

Polynuclear Aromatic Hydrocarbon and Total Petroleum Hydrocarbon Results

June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-30 6/4/2003 GW-060403-08	MWA-32ia 6/4/2003 GW-060403-10	MWA-32 (Dup) 6/4/2003 GW-060403-11	Rinsate 6/4/2003 GW-060403-09
TPH						
Diesel Range Organics	NWTPH-Dx	mg/L	0.642	0.342	0.32	0.25 U
Heavy Oil Range Hydrocarbon	NWTPH-Dx	mg/L	0.500 U	0.500 U	0.500 U	0.500 U
PAHs						
Acenaphthene	8270 Mod	µg/L	0.100 U	0.272	0.256	0.125 U
Acenaphthylene	8270 Mod	µg/L	0.100 U	0.100 U	0.100 U	0.125 U
Anthracene	8270 Mod	µg/L	0.100 U	0.118	0.101	0.125 U
Benzo (a) anthracene	8270 Mod	µg/L	0.100 U	0.100 U	0.100 U	0.125 U
Benzo (a) pyrene	8270 Mod	µg/L	0.100 U	0.100 U	0.100 U	0.125 U
Benzo (b) fluoranthene	8270 Mod	µg/L	0.100 U	0.100 U	0.100 U	0.125 U
Benzo (ghi) perylene	8270 Mod	µg/L	0.100 U	0.100 UJ	0.100 UJ	0.125 UJ
Benzo (k) fluoranthene	8270 Mod	µg/L	0.100 U	0.100 U	0.100 U	0.125 U
Chrysene	8270 Mod	µg/L	0.100 U	0.100 U	0.100 U	0.125 U
Dibenzo (a,h) anthracene	8270 Mod	µg/L	0.200 U	0.200 U	0.200 U	0.250 U
Fluoranthene	8270 Mod	µg/L	0.100 U	0.100 U	0.100 U	0.125 U
Fluorene	8270 Mod	µg/L	0.100 U	0.269	0.229	0.125 U
Indeno (1,2,3-cd) pyrene	8270 Mod	µg/L	0.100 U	0.100 UJ	0.100 UJ	0.125 UJ
Naphthalene	8270 Mod	µg/L	0.100 U	0.531	0.494	0.125 U
Phenanthrene	8270 Mod	µg/L	0.110 U	0.579	0.548	0.125 U
Pyrene	8270 Mod	µg/L	0.100 U	0.241	0.185	0.125 U

Notes: F - Field quality control sample criteria not met

J - Estimated

R - Rejected

U - Undetected at detection limit shown

NA - Not analyzed

Table 6
ATOFINA Chemicals, Inc. - Portland, Oregon
Pesticide Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-2 6/9/2003 GW-060903-01	MWA-3 6/9/2003 GW-060903-04	MWA-4 6/9/2003 GW-060903-07	MWA-5 6/6/2003 GW-060603-06	MWA-6r 6/5/2003 GW-060503-02	MWA-7 6/4/2003 GW-060403-01	MWA-8i 6/9/2003 GW-060903-02
4,4´-DDD	8081A	µg/L	4.00 U	0.0861	3.97	0.0400 U	0.0400 R	0.0400 UJ	0.0400 U
4,4´-DDE	8081A	µg/L	8.00 U	0.0800 U	0.233	0.0800 U	0.0800 R	0.0800 UJ	0.0800 U
4,4´-DDT	8081A	µg/L	8.00 U	0.362	0.0899 U	0.0916	0.214 J	0.0800 UJ	0.0800 U
Aldrin	8081A	µg/L	8.00 U	0.0800 U	0.0899 U	0.0800 U	0.0800 R	0.0800 UJ	0.0800 U
alpha-BHC	8081A	µg/L	4.00 U	0.0400 U	0.0449 U	0.0400 U	0.0400 R	0.0400 UJ	0.0400 U
alpha-Chlordane	8081A	µg/L	4.00 U	0.0400 U	0.0449 U	0.0400 U	0.0400 R	0.0400 UJ	0.0400 U
beta-BHC	8081A	µg/L	4.00 U	0.0400 U	0.0449 U	0.0400 U	0.0400 R	0.0400 UJ	0.0400 U
Chlordane (tech)	8081A	µg/L	50.0 U	0.500 U	0.562 U	0.500 U	0.500 R	0.500 UJ	0.500 U
delta-BHC	8081A	µg/L	10.0 U	0.100 U	0.112 U	0.100 U	0.100 R	0.100 UJ	0.100 U
Dieldrin	8081A	µg/L	8.00 U	0.0800 U	0.0899 U	0.0800 U	0.0800 R	0.0800 UJ	0.0800 U
Endosulfan I	8081A	µg/L	2.00 U	0.0200 U	0.0225 U	0.0200 U	0.0200 R	0.0200 UJ	0.0200 U
Endosulfan II	8081A	µg/L	8.00 U	0.0800 U	0.0899 U	0.0800 U	0.0800 R	0.0800 UJ	0.0800 U
Endosulfan sulfate	8081A	µg/L	10.0 U	0.100 U	0.112 U	0.100 U	0.100 R	0.100 UJ	0.100 U
Endrin	8081A	µg/L	8.00 U	0.0800 U	0.0899 U	0.0800 U	0.0800 R	0.0800 UJ	0.0800 U
Endrin aldehyde	8081A	µg/L	16.0 U	0.160 U	0.180 U	0.160 U	0.160 R	0.160 UJ	0.160 U
Endrin ketone	8081A	µg/L	8.00 U	0.0800 U	0.0899 U	0.0800 U	0.0800 R	0.0800 UJ	0.0800 U
gamma-BHC (Lindane)	8081A	µg/L	4.00 U	0.0400 U	0.0449 U	0.0400 U	0.0400 R	0.0400 UJ	0.0400 U
gamma-Chlordane	8081A	µg/L	4.00 U	0.0400 U	0.0449 U	0.0400 U	0.0400 R	0.0400 UJ	0.0400 U
Heptachlor	8081A	µg/L	8.00 U	0.0800 U	0.0899 U	0.0800 U	0.0800 R	0.0800 UJ	0.0800 U
Heptachlor epoxide	8081A	µg/L	4.00 U	0.0400 U	0.0449 U	0.0400 U	0.0400 R	0.0400 UJ	0.0400 U
Methoxychlor	8081A	µg/L	50.0 U	0.500 U	0.562 U	0.500 U	0.500 R	0.500 UJ	0.500 U
Toxaphene	8081A	µg/L	200 U	2.00 U	2.25 U	2.00 U	2.00 R	2.00 UJ	2.00 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 6
ATOFINA Chemicals, Inc. - Portland, Oregoı
Pesticide Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-9i 6/9/2003 GW-060903-06	MWA-10i 6/10/2003 GW-061003-01	MWA-11i 6/10/2003 GW-061003-03	MWA-12i 6/3/2003 GW-060303-01	MWA-13d 6/9/2003 GW-060903-03	MWA-14i 6/6/2003 GW-060603-07	MWA-15r 6/10/2003 GW-061003-04
4,4′-DDD	8081A	µg/L	1.1	0.0455 UJ	1.2	0.0400 UJ	0.0807	0.0439	28.4 J
4,4′-DDE	8081A	µg/L	0.0899 U	0.0909 UJ	0.0800 U	0.0800 UJ	0.0800 U	0.0800 U	16.0 U
4,4′-DDT	8081A	µg/L	0.0899 U	0.0909 UJ	0.573 U	0.0800 UJ	0.0800 U	0.0800 U	113
Aldrin	8081A	µg/L	0.0899 U	0.0909 UJ	0.0800 U	0.0800 UJ	0.0800 U	0.0800 U	16.0 U
alpha-BHC	8081A	µg/L	0.0449 U	0.0455 UJ	0.0400 U	0.0400 UJ	0.0400 U	0.0400 U	8.00 U
alpha-Chlordane	8081A	µg/L	0.0449 U	0.0455 UJ	0.0400 U	0.0400 UJ	0.0400 U	0.0400 U	8.00 U
beta-BHC	8081A	µg/L	0.0449 U	0.0455 UJ	0.0400 U	0.0400 UJ	0.0400 U	0.0400 U	8.00 U
Chlordane (tech)	8081A	µg/L	0.562 U	0.568 UJ	0.500 U	0.500 UJ	0.500 U	0.500 U	100 U
delta-BHC	8081A	µg/L	0.112 U	0.114 UJ	0.100 U	0.100 UJ	0.100 U	0.100 U	20.0 U
Dieldrin	8081A	µg/L	0.0899 U	0.0909 UJ	0.0800 U	0.0800 UJ	0.0800 U	0.0800 U	16.0 U
Endosulfan I	8081A	µg/L	0.0225 U	0.0227 UJ	0.0200 U	0.0200 UJ	0.0200 U	0.0200 U	4.38
Endosulfan II	8081A	µg/L	0.0899 U	0.0909 UJ	0.0800 U	0.0800 UJ	0.0800 U	0.0800 U	16.0 U
Endosulfan sulfate	8081A	µg/L	0.112 U	0.114 UJ	0.100 U	0.100 UJ	0.100 U	0.100 U	20.0 U
Endrin	8081A	µg/L	0.0899 U	0.0909 UJ	0.0800 U	0.0800 UJ	0.0800 U	0.0800 U	16.0 U
Endrin aldehyde	8081A	µg/L	0.180 U	0.182 UJ	0.160 U	0.160 UJ	0.160 U	0.160 U	32.0 U
Endrin ketone	8081A	µg/L	0.0899 U	0.0909 UJ	0.0800 U	0.0800 UJ	0.0800 U	0.0800 U	16.0 U
gamma-BHC (Lindane)	8081A	µg/L	0.0449 U	0.0455 UJ	0.0400 U	0.0400 UJ	0.0400 U	0.0400 U	8.00 U
gamma-Chlordane	8081A	µg/L	0.0449 U	0.0455 UJ	0.0400 U	0.0400 UJ	0.0400 U	0.0400 U	8.00 U
Heptachlor	8081A	µg/L	0.0899 U	0.0909 UJ	0.0800 U	0.0800 UJ	0.0800 U	0.0800 U	16.0 U
Heptachlor epoxide	8081A	µg/L	0.0449 U	0.0455 UJ	0.0400 U	0.0400 UJ	0.0400 U	0.0400 U	8.00 U
Methoxychlor	8081A	µg/L	0.562 U	0.568 UJ	0.500 U	0.500 UJ	0.500 U	0.500 U	100 U
Toxaphene	8081A	µg/L	2.25 U	2.27 UJ	2.00 U	2.00 UJ	2.00 U	2.00 U	400 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 6
ATOFINA Chemicals, Inc. - Portland, Oregoı
Pesticide Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-16i 6/5/2003 GW-060503-01	MWA-17si 6/9/2003 GW-060903-05	MWA-18 6/6/2003 GW-060603-03	MWA-19 6/6/2003 GW-060603-04	MWA-20 6/5/2003 GW-060503-03	MWA-22 6/10/2003 GW-061003-02	MWA-24 6/5/2003 GW-060503-04
4,4′-DDD	8081A	µg/L	0.0400 R	1.44	0.0400 U	0.0935	0.0688 J	0.13 U	0.232 U
4,4′-DDE	8081A	µg/L	0.0800 R	0.400 U	0.0800 U	0.0800 U	0.0800 R	0.0800 UJ	0.160 U
4,4′-DDT	8081A	µg/L	0.0800 R	0.400 U	0.0800 U	0.23	0.213 J	0.348 U	0.160 U
Aldrin	8081A	µg/L	0.0800 R	0.400 U	0.0800 U	0.0800 U	0.0800 R	0.0800 UJ	0.160 U
alpha-BHC	8081A	µg/L	0.0400 R	0.200 U	0.0400 U	0.0400 U	0.0400 R	0.0400 UJ	0.0800 U
alpha-Chlordane	8081A	µg/L	0.0400 R	0.200 U	0.0400 U	0.0400 U	0.0400 R	0.0400 UJ	0.0800 U
beta-BHC	8081A	µg/L	0.0400 R	0.200 U	0.0400 U	0.0400 U	0.0400 R	0.0400 UJ	0.0800 U
Chlordane (tech)	8081A	µg/L	0.500 R	2.50 U	0.500 U	0.500 U	0.500 R	0.500 UJ	1.00 U
delta-BHC	8081A	µg/L	0.100 R	0.500 U	0.100 U	0.100 U	0.100 R	0.100 UJ	0.200 U
Dieldrin	8081A	µg/L	0.0800 R	0.400 U	0.0800 U	0.0800 U	0.0800 R	0.0800 UJ	0.160 U
Endosulfan I	8081A	µg/L	0.0200 R	0.100 U	0.0200 U	0.0200 U	0.0200 R	0.0200 UJ	0.0400 U
Endosulfan II	8081A	µg/L	0.0800 R	0.400 U	0.0800 U	0.0800 U	0.0800 R	0.0800 UJ	0.160 U
Endosulfan sulfate	8081A	µg/L	0.100 R	0.500 U	0.100 U	0.100 U	0.100 R	0.100 UJ	0.200 U
Endrin	8081A	µg/L	0.0800 R	0.400 U	0.0800 U	0.0800 U	0.0800 R	0.0800 UJ	0.160 U
Endrin aldehyde	8081A	µg/L	0.160 R	0.800 U	0.160 U	0.160 U	0.160 R	0.160 UJ	0.320 U
Endrin ketone	8081A	µg/L	0.0800 R	0.400 U	0.0800 U	0.0800 U	0.0800 R	0.0800 UJ	0.160 U
gamma-BHC (Lindane)	8081A	µg/L	0.0400 R	0.389	0.0400 U	0.0400 U	0.0400 R	0.0400 UJ	0.0800 U
gamma-Chlordane	8081A	µg/L	0.0400 R	0.200 U	0.0400 U	0.0400 U	0.0400 R	0.0400 UJ	0.0800 U
Heptachlor	8081A	µg/L	0.0800 R	0.400 U	0.0800 U	0.0800 U	0.0800 R	0.0800 UJ	0.160 U
Heptachlor epoxide	8081A	µg/L	0.0400 R	0.428	0.0400 U	0.0400 U	0.0400 R	0.0400 UJ	0.0800 U
Methoxychlor	8081A	µg/L	0.500 R	2.50 U	0.500 U	0.500 U	0.500 R	0.500 UJ	1.00 U
Toxaphene	8081A	µg/L	2.00 R	10.0 U	2.00 U	2.00 U	2.00 R	2.00 UJ	4.00 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 6
ATOFINA Chemicals, Inc. - Portland, Oregoı
Pesticide Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-29 6/4/2003 GW-060403-06	MWA-30 6/4/2003 GW-060403-08	MWA-31i 6/4/2003 GW-060403-07	MWA-32ia 6/4/2003 GW-060403-10	MWA-33a 6/5/2003 GW-060503-05	MWA-33 6/11/2003 GW-061103-02	MWA-33 6/11/2003 GW-061103-03
4,4′-DDD	8081A	µg/L	0.0400 UJ	0.0400 UJ	0.0400 U	0.0400 UJ	0.0400 R	0.0400 UJ	0.0400 UJ
4,4′-DDE	8081A	µg/L	0.0800 UJ	0.0800 UJ	0.0800 U	0.0800 UJ	0.0800 R	0.0800 UJ	0.0800 UJ
4,4′-DDT	8081A	µg/L	0.0800 UJ	0.0800 UJ	0.0800 U	0.0800 UJ	0.0800 R	0.518 U	0.678 U
Aldrin	8081A	µg/L	0.0800 UJ	0.0800 UJ	0.0800 U	0.0800 UJ	0.0800 R	0.0800 UJ	0.0800 UJ
alpha-BHC	8081A	µg/L	0.0400 UJ	0.0400 UJ	0.0400 U	0.0400 UJ	0.0400 R	0.0400 UJ	0.0400 UJ
alpha-Chlordane	8081A	µg/L	0.0400 UJ	0.0400 UJ	0.0400 U	0.0400 UJ	0.0400 R	0.0400 UJ	0.0400 UJ
beta-BHC	8081A	µg/L	0.0400 UJ	0.0400 UJ	0.0400 U	0.0400 UJ	0.0400 R	0.0400 UJ	0.0400 UJ
Chlordane (tech)	8081A	µg/L	0.500 UJ	0.500 UJ	0.500 U	0.500 UJ	0.500 R	0.500 UJ	0.500 UJ
delta-BHC	8081A	µg/L	0.100 UJ	0.100 UJ	0.100 U	0.100 UJ	0.100 R	0.100 UJ	0.100 UJ
Dieldrin	8081A	µg/L	0.0800 UJ	0.0800 UJ	0.0800 U	0.0800 UJ	0.0800 R	0.0800 UJ	0.0800 UJ
Endosulfan I	8081A	µg/L	0.0200 UJ	0.0200 UJ	0.0200 U	0.0200 UJ	0.0200 R	0.0200 UJ	0.0200 UJ
Endosulfan II	8081A	µg/L	0.0800 UJ	0.0800 UJ	0.0800 U	0.0800 UJ	0.0800 R	0.0800 UJ	0.0800 UJ
Endosulfan sulfate	8081A	µg/L	0.100 UJ	0.100 UJ	0.100 U	0.100 UJ	0.100 R	0.100 UJ	0.100 UJ
Endrin	8081A	µg/L	0.0800 UJ	0.0800 UJ	0.0800 U	0.0800 UJ	0.0800 R	0.0800 UJ	0.0800 UJ
Endrin aldehyde	8081A	µg/L	0.160 UJ	0.160 UJ	0.160 U	0.160 UJ	0.160 R	0.160 UJ	0.160 UJ
Endrin ketone	8081A	µg/L	0.0800 UJ	0.0800 UJ	0.0800 U	0.0800 UJ	0.0800 R	0.0800 UJ	0.0800 UJ
gamma-BHC (Lindane)	8081A	µg/L	0.0400 UJ	0.0400 UJ	0.0400 U	0.0400 UJ	0.0400 R	0.0400 UJ	0.0400 UJ
gamma-Chlordane	8081A	µg/L	0.0400 UJ	0.0400 UJ	0.0400 U	0.0400 UJ	0.0400 R	0.0400 UJ	0.0400 UJ
Heptachlor	8081A	µg/L	0.0800 UJ	0.0800 UJ	0.0800 U	0.0800 UJ	0.0800 R	0.0800 UJ	0.0800 UJ
Heptachlor epoxide	8081A	µg/L	0.0400 UJ	0.0400 UJ	0.0400 U	0.0400 UJ	0.0400 R	0.0400 UJ	0.0400 UJ
Methoxychlor	8081A	µg/L	0.500 UJ	0.500 UJ	0.500 U	0.500 UJ	0.500 R	0.500 UJ	0.500 UJ
Toxaphene	8081A	µg/L	2.00 UJ	2.00 UJ	2.00 U	2.00 UJ	2.00 R	2.00 UJ	2.00 UJ

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Table 6
ATOFINA Chemicals, Inc. - Portland, Oregoı
Pesticide Results
June 2003 Groundwater Sampling

Analyte	Method	Units	MWA-34ia 6/6/2003 GW-060603-05	NMP-3D 6/11/2003 GW-061103-01	NMP-4D 6/10/2003 GW-061003-06	NMP-4D (Dup) 6/10/2003 GW-061003-07	Rinsate 6/5/2003 GW-060503-07	Rinsate 6/10/2003 GW-061003-05
4,4′-DDD	8081A	μg/L	0.0892	0.800 U	6.26 J	8.86 J	0.0400 U	0.0412 J
4,4′-DDE	8081A	μg/L	0.0800 U	1.60 U	8.00 U	8.00 U	0.0800 U	0.0800 U
4,4′-DDT	8081A	μg/L	0.327	5.8 U	282	235	0.0800 U	1.19
Aldrin	8081A	μg/L	0.0800 U	1.60 U	8.00 U	8.00 U	0.0800 U	0.0800 U
alpha-BHC	8081A	μg/L	0.0400 U	0.800 U	4.00 U	4.00 U	0.0400 U	0.0400 U
alpha-Chlordane	8081A	μg/L	0.0400 U	0.800 U	4.00 U	4.00 U	0.0400 U	0.0400 U
beta-BHC	8081A	μg/L	0.0400 U	0.800 U	4.00 U	4.00 U	0.0400 U	0.0400 U
Chlordane (tech)	8081A	μg/L	0.500 U	10.0 U	50.0 U	50.0 U	0.500 U	0.500 U
delta-BHC	8081A	μg/L	0.100 U	2.00 U	10.0 U	10.0 U	0.100 U	0.100 U
Dieldrin	8081A	μg/L	0.0800 U	1.60 U	8.00 U	8.00 U	0.0800 U	0.0800 U
Endosulfan I	8081A	μg/L	0.0200 U	0.400 U	2.00 U	2.00 U	0.0200 U	0.0200 U
Endosulfan II	8081A	μg/L	0.0800 U	1.60 U	8.00 U	8.00 U	0.0800 U	0.0800 U
Endosulfan sulfate	8081A	μg/L	0.100 U	2.00 U	10.0 U	10.0 U	0.100 U	0.100 U
Endrin	8081A	μg/L	0.0800 U	1.60 U	8.00 U	8.00 U	0.0800 U	0.0800 U
Endrin aldehyde	8081A	μg/L	0.160 U	3.20 U	16.0 U	16.0 U	0.160 U	0.160 U
Endrin ketone	8081A	μg/L	0.0800 U	1.60 U	8.00 U	8.00 U	0.0800 U	0.0800 U
gamma-BHC (Lindane)	8081A	μg/L	0.0400 U	0.800 U	4.00 U	4.00 U	0.0400 U	0.0400 U
gamma-Chlordane	8081A	μg/L	0.0400 U	0.800 U	4.00 U	4.00 U	0.0400 U	0.0400 U
Heptachlor	8081A	μg/L	0.0800 U	1.60 U	8.00 U	8.00 U	0.0800 U	0.0800 U
Heptachlor epoxide	8081A	μg/L	0.0400 U	1.15	4.00 U	4.00 U	0.0400 U	0.0400 U
Methoxychlor	8081A	μg/L	0.500 U	10.0 U	50.0 U	50.0 U	0.500 U	0.500 U
Toxaphene	8081A	μg/L	2.00 U	40.0 U	200 U	200 U	2.00 U	2.00 U

Notes: F - Field quality control sample criteria not met
J - Estimated
R - Rejected
U - Undetected at detection limit shown
NA - Not analyzed

Appendix A-3

Cascade General (Portland Shipyard)

CASCADE GENERAL SHIP REPAIR YARD

Oregon DEQ ECSI #: 271

5555 North Channel Avenue
DEQ Site Mgr: Jim Anderson
Latitude: 45.5669°
Longitude: -122.7194°
Township/Range/Section: 1N, 1E, 20

River Mile: 8.5 East bank

LWG Member ☒ Yes[1] ☐ No

Upland Analytical Data Status: ☒ Electronic Data Available ☐ Hardcopies only

1. SUMMARY OF POTENTIAL CONTAMINANT TRANSPORT PATHWAYS TO THE RIVER

The current understanding of the transport mechanism of contaminants from the uplands portions of the site to the river is summarized in this section and Table 1 and supported in following sections.

1.1. Overland Transport

There are no known contaminated overland transport pathways from the site to the river. The portion of the site that is owned by Cascade General and operated as a shipyard is almost entirely paved with asphalt or concrete or covered with buildings. The portion of the site that is owned by the Port of Portland (the party performing the overall investigation and cleanup) is partially paved with asphalt; the remainder of the Port-owned property is unpaved and undeveloped, but does not drain to the Willamette River, except in one localized area near the east end of the N. Channel Avenue Fabrication site. There is currently not enough information to determine if there is a complete pathway from this localized area to the river.

1.2. Riverbank Erosion

Riverbank erosion is not known to be transport pathway. Most of the site shoreline is covered with berth, pier, and dry dock structures. There is no evidence of riverbank erosion along the remaining portions of the shoreline.

1.3. Groundwater

There are no known contaminated groundwater discharges from the site to the river. There are no known preferential groundwater migration pathways at the site.

1.4. Direct Discharge (Over water Activities and Stormwater/Wastewater Systems)

<u>Over water Activities</u>

[1] The Port of Portland is undertaking the investigation and remediation of the Ship Repair Yard site.

Historical over water releases may have occurred from operations such as abrasive blasting, painting, and general ship repair. Historical industrial and commercial activities (e.g., prior to system permitting and release reporting requirements) were not well documented and few records exist. For example, releases incidental to site operations were not required to be documented or reported. The little information that is known is anecdotal in nature. Historical documented releases are discussed in Section 8.3.

In more recent years, Best Management Practices (BMPs) and dry dock water treatment have been implemented under government agency approved permits to control potential releases associated with over water and ship repair-related activities.

Stormwater Systems
Historical stormwater releases may have occurred from outfalls that conveyed stormwater collected in upland areas where ship repair-related activities occurred. In more recent years, BMPs have been implemented under government agency approved permits to control potential releases associated with stormwater. As was discussed above, stormwater from one localized area near the east end of the N. Channel Avenue Fabrication site is captured by a catch basin connected to a storm drain that discharges to the river. There is currently not enough information to determine if there is a complete pathway from this localized area to the river.

Wastewater Systems
Wastewater discharges from the Ballast Water Treatment Plant (BWTP), dry dock stormwater treatment system, former air compressor, and former boiler are regulated under government agency-approved permits.

1.5. Relationship of Upland Sources to River Sediments

See Final CSM Update.

1.6. Sediment Transport

The Cascade General – Portland Shipyard occupies the downstream end of the Swan Island peninsula that separates the main river stem from the Swan Island Lagoon. The river's cross-section is wide here and this reach is characterized as depositional based on the site physical information compiled in the Programmatic Work Plan (Integral et al. 2004). The Sediment Trend Analysis® results indicate either net accretion or total deposition along the entire nearshore area surrounding the Shipyard. Downstream and on the lagoon side of the Shipyard, some dynamic equilibrium transport paths are also evident. Time-series bathymetric change data over the 25-month period from January 2002 through February 2004 (Integral and DEA 2004, in prep) show a mosaic of net deposition and net accretion areas (up to 2 ft in extent) immediately adjacent to property on both the river and the lagoon sides. Both net erosion and net deposition areas are also evident within and adjacent to the Shipyard piers. Two large, former drydock locations show sediment accumulation up to 2+ ft. Several areas of net sediment scour ranging from 0.5 to 2 ft in extent are evident just downstream of the piers. Areas of sediment erosion in the vicinity of the Shipyard may reflect prop-wash induced movement of sediments from ship traffic Further away from the facility both in the main river stem and downstream of the Swan Island peninsula, there are large areas of sediment accumulation at channel depth (-30 to -40 NAVD88) (Integral and DEA, 2004).

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2. CSM SITE SUMMARY REVISIONS

Date of Last Revision: September 16, 2004

3. PROJECT STATUS

[Primary Source: ECSI file and DEQ Staff Report]

Activity		Date(s)/Comments
PA/XPA	☐	
RI	☒	Phases I and II of the RI were performed between July 2001 and the end of 2003
FS	☐	
Interim Action/Source Control	☐	
ROD	☐	
RD/RA	☐	
NFA	☐	

DEQ Portland Harbor Site Ranking (Tier 1, 2, or 3): 1

4. SITE OWNER HISTORY

Owner/Occupant	Type of Operation	Years
	None – Swan Island was a periodically flooded sand bar and marsh located in the main channel of the Willamette River	<1922
Port of Portland/Department of State Lands	Swan Island was excavated for the navigation channel and filled at its southerly base and connected to the east shore of the Willamette River when the main navigation channel was relocated to the west side of Swan Island	1922 to 1931
Port of Portland	Runways, taxiways, administration building, and hangars for a municipal airport were formerly located on the site	1931 to 1941
Port of Portland/U.S. Maritime Commission and Kaiser Company, Inc./Department of State Lands	Requisitioned for demolition of airport and construction of military shipyard. Ship construction and repair.	1942 to 1947
Port of Portland/U.S. Maritime Commission /War Assets Administration	Steel fabrication and storage, ship dismantling and scrapping, wood products manufacturing, equipment manufacturing, maritime supply sales, printing, chemical and soap storage, war surplus storage, fire extinguisher service and storage, paint storage, aluminum oil tank manufacturing, service station operation, sheet metal work, roofing supply storage, and general office storage	1947 to 1951
Port of Portland/multiple contractors and tenants	Ship repair and other industrial operations.	1951 to 1996
Port of Portland/Cascade General	Ship repair and other industrial operations (Cascade General took over shipyard operations, maintenance, tenant management and environmental issues)	1996 to 2000

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Cascade General	Ship repair yard and other industrial operations (Cascade General owned portion of site)	2000 to Present
Port of Portland	Parking lot and undeveloped property (Port owned portion of site)	2000 to Present

5. PROPERTY DESCRIPTION

The site comprises 94 acres of uplands of which 57 acres are owned by Cascade General Corporation (Cascade General) and the remaining 37 acres, mainly located south of N. Channel Avenue, are owned by the Port (see Figure 1). Cascade General also owns 106 acres of submerged lands (see Figure 1).

The site was generally flat with an approximate elevation of 40 feet above mean sea level (MSL). Surrounding properties have industrial and commercial uses.

The portion of the site owned by Cascade General is almost entirely paved with asphalt or concrete or covered with buildings. Approximately 29 the 37 acres owned by the Port are unpaved and undeveloped within an area referred to as the N. Channel Avenue fabrication site. The remaining land is an asphalt paved parking lot located adjacent to and northwest of the N. Channel Avenue fabrication site and a paved parcel with a building located between N. Lagoon Avenue and Swan Island Lagoon, near Berth 307.

Stormwater on the portion of the site owned by Cascade General is collected by a series of catch basins that discharge to the Willamette River through outfalls under Cascade's NPDES permit. Many of these outfalls discharge stormwater from localized areas along individual berths. Stormwater on the asphalt-paved portion of the site owned by the Port is collected by a series of catch basins connected to an outfall that discharges to the Willamette River near Berth 305 under the Port's Municipal Separate Storm Sewer System permit. Stormwater from the undeveloped portion of the Port-owned property mainly infiltrates into the ground, except in the east end of the N. Channel Avenue Fabrication site where one catch basin collects stormwater from a localized area for discharge to the Willamette River.

Cascade General conducts ship repair and maintenance at dry docks and 15 berths along the perimeter of the shipyard. The dry docks are used for raising vessels out of the water. The berths are outfitted with electrically powered cranes in a variety of sizes and lift capacities. The cranes operate on tracks that are laid along the berths and allow them mobility between the berths. The berths are also used for maintenance that does not require lifting the vessel out of the water. Numerous buildings house the support services for both ship repair operations and maintenance of the shipyard infrastructure.

Cascade General owns and operates a permitted Ballast Water Treatment Plant (BWTP), a treatment plant that accepts oily waste from vessel cleaning and maintenance. The oily waste is temporarily stored in tanks and the oil is extracted by natural separation, addition of chemicals, and heating of the wastewater. The reclaimed oil is recycled. Cascade General also owns a stormwater treatment system to treat water from the dry docks. The stormwater treatment system uses chemical and mechanical processes to remove contaminants. Treated water is either pumped to the city sewer system or discharged to the Willamette River under Cascade General's NPDES permit, depending upon analytical results.

Petroleum products are stored in underground storage tanks (USTs).

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6. CURRENT SITE USE

The portion of the site owned by Cascade General is currently used for ship repair. Current activities performed by Cascade General at the dry docks include hull repair, maintenance, painting, and other dry lay-up ship repair tasks. Current activities performed at the berths include cleaning tanker vessel ballasts, engine maintenance, outfitting, deck painting, and other activities. Ancillary operations performed in the various upland buildings include:

- Metal machining (for facilities maintenance and ship repair)
- Carpentry
- Electrical shop
- Steel fabrication
- Propeller repair and services
- Mobile equipment maintenance
- Paint storage and painting operations
- Abrasive blasting (grit and steel shot) and surface preparations
- Berth and ship rigging storage and support

The unpaved and undeveloped portion of the Port-owned property is not currently being used. The paved portion of the Port-owned property located southwest of N. Channel Avenue is used as a parking lot for ship yard workers. The paved and developed portion of the Port-owned property located between N. Lagoon Avenue and Swan Island Lagoon was formerly leased by Foss Environmental; this property is not currently being used.

7. SITE USE HISTORY

Swan Island was originally a periodically flooded sand bar and marsh within the main channel of the Willamette River, owned by the State of Oregon, running between the island and Mocks Bottom to the east. The Willamette River on the west side of the island was too shallow for ship navigation.

The Port purchased Swan Island in 1922. In 1923, an excavation and dredging project was initiated to relocate the main channel of the Willamette River from the east side of the island to the west side of the island, and to raise the island to 32 feet above mean low water. In 1927, a causeway was built in the east channel from the mainland to the island, and the south end of Mocks Bottom was raised, making a peninsula of the island and creating a still water lagoon of the east channel. This lagoon is now referred to as the Swan Island Lagoon area of the lower Willamette.

In 1926, the Port began construction of a municipal airport at the site. Airport development was completed in 1931. The site served at a municipal airport until operations ended in 1941. In 1942, airport operations were moved to the current location of Portland International Airport. The northwestern end of the landing field (runways and taxiways), administration building, and hangars were formerly located on the site.

In 1942, the Port leased 250 acres of Swan Island to the United States Maritime Commission (USMC). The USMC then contracted with Kaiser Company Inc. (Kaiser) to construct and operate a shipyard facility (the Military Shipyard). Development of the Military Shipyard began in April 1942. In the same year, Kaiser started shipyard construction, including dredging a "basin" in the Willamette River for purposes of operating a dry dock (currently Dry Dock 1). By March 1943, Kaiser was manufacturing

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Liberty Ship T-2 tankers from the yard. In 1945, the USMC's lease was extended until 1952. Kaiser used the Military Shipyard for ship repair and other industrial enterprises until 1947, when the War Assets Administration (WAA) declared the shipyard's assets to be surplus. The WAA then leased the Military Shipyard's buildings and property to a number of tenants for industrial uses, such as steel fabrication and storage, ship dismantling and scrapping, wood products manufacturing, equipment manufacturing, maritime supply sales, printing, chemical and soap storage, war surplus storage, fire extinguisher service and storage, paint storage, aluminum oil tank manufacturing, service station operation, sheet metal work, roofing supply storage, and general office storage. Also at that time, the WAA leased a part of the Military Shipyard to Consolidated Builders, Inc. (CBI), a Kaiser affiliate, who began scrapping decommissioned Liberty ships. Approximately seventeen ships were dismantled by CBI between 1947 and 1949 when CBI ended ship-breaking operations. During the war, the areas around the shipyard, including Swan Island Lagoon, were used to moor military vessels. Moreover, the areas around the shipyard, including Swan Island Lagoon, were used after the war for mooring military vessels pending their final disposition. In 1949, the WAA surrendered the lease of the Military Shipyard, but continued to hold individual facility leases.

In 1951, WAA equipment and improvements and possession of the former Military Shipyard were transferred to the Port. The Port began operating the Portland Shipyard in 1950. Various developments occurred from the 1950s through the 1980s. This included the dredging of another basin and installation of Dry Dock 2. In 1957, the Port dredged a third basin and installed Dry Dock 3. By 1964, the former airport terminal was torn down. Construction of shipyard facility additions and new structures continued during the late 1960s and early 1970s. Facility construction included a treatment plant to manage ballast water (now referred to as the BWTP). This plant was constructed in 1973 and replaced by the current plant in 1979. A new barge construction transfer system was built in 1975 near Dry Dock 3. A large employee parking lot was constructed in the south-central portion of the Site in 1977. The next year, a basin for Dry Dock 4 was dredged. Dry Dock 4 was placed into operation in 1979. During this same timeframe, the new side of the yard (referred to as the "new yard") and Berths 312 through 314 were constructed. During the 1980s until approximately 1989, ARCO undertook major module fabrication at the N. Channel Avenue fabrication site to support oil exploration activities in Alaska. During this period, the only other substantive changes to the shipyard included taking Dry Dock 2 out of service.

From 1949 to 1996, when the Port owned the shipyard, a number of contractors performed ship repair activities at the dry dock facilities and a number of tenants performed industrial operations in leased premises, including Albina Engine and Machine Works, Willamette Iron and Steel Company, Northwest Marine Iron Works, Willamette Tug and Barge Company, Gunderson, Crosby & Overton, Pacific Marine Services, and Dillingham Ship Repair.

Starting January 1, 1996, Cascade General took over all shipyard operations, maintenance, and tenant management. In June 2000, the Port sold the Portland Shipyard uplands and submerged lands to Cascade General.

8. CURRENT AND HISTORIC SOURCES AND COPCS

The understanding of historic and current potential upland and over water sources at the site is summarized in Table 1. The following sections provide a brief overview of the potential sources and COPCs at the site requiring additional discussion.

8.1. *Uplands*

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The 2000 RI/FS Work Plan identified known and suspected upland sources at the site (Bridgewater Group, 2000). As Table 1 indicates, sources with potentially complete pathways to the river include:

- **BWTP** – Original BWTP facilities initially included five ponds that provided for the treatment and containment of ballast water. Three of the five ponds were filled, and the other two ponds were reconfigured during the construction of the new BWTP. The two reconfigured ponds were active holding ponds until sometime between 1979 and 1981 when Building 72 was constructed.

- **Building 73** - Sandblasting, grit blasting, metal shot blasting, and parts painting are conducted in Building 73. The south half of the building is used for surface preparation and north half is the paint booth. Building 73 was constructed in 1980 and 1981. Prior to its construction, the area was used for lay-down of shipbuilding parts during the Kaiser shipbuilding era and as an unpaved storage yard between during the 1950s, 1960s and 1970s. Chemicals used at Building 73 include solvents and oil-based paints. Blasting media are also stored and used in the building. Solvents are stored in dip tanks located on the south wall of the building.

- **Paint Shed/Blast Booth area** – The surfaces of metal ship parts were blasted and painted in the paint shed and blast booths. The paint shed/blast booth area is located east of Building 73 and west of Building 4. This area was also historically used to store sandblast grit near Berth 313.

- **Substations** – There are nine electrical substations (Substations 1 through 8 and the Central Utility Building [CUB] Substation) present on the portion of the site owned by Cascade General (see supplemental Figure 16 [Revised] from Bridgewater Group [2001]). Three of the nine substations (i.e., Substations 2, 3 and 4) are located inside buildings. Two of the substations (i.e., Substation 1 and the CUB Substation) are located outside near the interior of the site. The remaining substations are also located outside near various berths. Since 1983, the electrical equipment in each substation has been inspected and surveyed for PCBs. A 1985 survey found that two transformers in Substation 1 and one transformer in Substation 4 contained PCBs. The Substation 4 transformer was removed in 1985. The Substation 1 transformers were removed in 1992. After that time, there were no PCBs in any of the in service transformers.

- **N. Channel Avenue Fabrication site** – From 1986 to 1990, the N. Channel Avenue Fabrication area was used by the Atlantic Richfield Company (ARCO) for the construction of modular units used for oil processing on Alaska's North Slope. Fabrication, finish painting and the application of fire retardant were conducted on concrete pads in the center of the area, with material storage, administrative modular trailers, and equipment stored around the perimeter of the area. Petroleum, fuel and solvents were stored in tanks and totes during the ARCO construction project. Three ASTs were located along the south side of Building 83.

  In 1978, the area was used as the staging and pre-cast concrete construction site for the BWTP. Between 1978 and the early 1940's the N. Channel Avenue fabrication site was primarily open, graded soil with railroad spurs used for material receiving and storage.

  After 1990, the N. Channel Avenue fabrication site was used for outdoor storage of equipment, steel, cable drums, empty portable tanks and totes, and other materials. Wood waste recycling also occurred in this area.

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The N. Channel Avenue Fabrication site is unpaved. There is no stormwater system, except for a single catch basin located near the east end of the property. The catch basin is connected to a storm drain that discharges to the Willamette River. Elsewhere, storm water infiltrates into the ground.

8.2. Overwater Activities

☒ Yes ☐ No

Current and historic over water activities include:

- Ship hull washing, abrasive blasting and painting in dry docks
- Ship hull abrasive blasting and outfitting at Berths 302, 303, 304, 305, 312, 313, 314, and 315

BMPs have been implemented and a dry dock stormwater treatment system was constructed to reduce releases associated with these over water activities.

8.3. Spills

The Port is currently in the process of compiling data related to historical spills and releases as part of the Portland Shipyard upland RI, a detailed summary of which will be included in that document. While some preliminary data regarding historical releases has been collected to date, the research is not complete and the integrity of the information has not been verified. At this point, the history is largely anecdotal and therefore not considered qualified for inclusion in the CSM. It is expected that newly-identified information for the Portland Shipyard pertinent to the CSM will be included in later iterations of this document.

The following is a summary of quantified spills that have been documented at the site since 1995 which may be pertinent to developing the conceptual site model. Other anecdotal releases are contained within the upland RI documents.

Date	Material(s) Released	Volume Spilled (gallons)	Spill Surface (gravel, asphalt, sewer)	Action Taken (yes /no)
10/17/95	Hydraulic oil	~1 gallon	Willamette River	Unknown
9/27/97	Diesel	~22 gallons	Willamette River	Unknown
11/13/97	Crude Oil	~100 gallons	Willamette River	Unknown
10/20/98	Fuel	~5 gallons	Unknown	Unknown
1/29/99	Hydraulic oil	~5 gallons	Unknown	Unknown
12/23/99	Bunker fuel and diesel	~2 gallons	Willamette River	Cleaned with pads
3/21/00	Diesel	~1 - 2 gallons	Unknown	Unknown
3/21/00	Diesel	~5 gallons	Unknown	Unknown
5/22/00	Diesel	~3 gallons	Unknown	Unknown
6/9/00	Hydraulic oil	~1 barrel	Willamette River	Spill response contractor took action
6/15/00	Unknown	~10 gallons	Unknown	Unknown
10/1/00	Lube oil	~2 gallons	Willamette River	Unknown
10/4/00	Lube oil	~5 gallons	Willamette River	Unknown

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Date	Material(s) Released	Volume Spilled (gallons)	Spill Surface (gravel, asphalt, sewer)	Action Taken (yes /no)
10/17/00	Bunker-like oil	~2 gallons	Willamette River	Unknown
11/27/00	Hydraulic oil (vegetable based)	~3 gallons	Willamette River	Unknown
12/19/00	Hydraulic oil	~2 gallons	Willamette River	Unknown
1/19/01	Hydraulic Oil	~0.5 gallon	Willamette River	Unknown
10/19/01	Lube oil	~1 pint	Willamette River	Unknown
4/11/02	Lube oil	~2 liters	Unknown	Unknown
11/9/02	Oil	~1 gallon	Unknown	Unknown

9. PHYSICAL SITE SETTING

9.1. Geology

- Over 50 push-probe borings and eleven hollow stem auger borings were installed for the collection of soil and groundwater samples as part of remedial investigation activities (Bridgewater Group, 2001 and 2002). The maximum depth of investigation is 40 feet bgs.
- Soils encountered in the borings were a mixture of silt, sandy silt, silty sand, sand, and sand with gravel (see cross-sections in Figures 2a, 2b and 2c). In general, sand and occasional gravel were encountered to a depth of approximately 20-feet bgs, likely representing materials dredged from the Willamette River to raise the surface elevation of Swan Island. Underlying the fill unit are variable mixtures of silt, sandy silt, silty sand, and sand, which appear to represent native alluvial deposits. The contact between the fill and underlying alluvial materials is not readily apparent in most borings (Hahn and Associates, 2002).

9.2. Hydrogeology

- There is little continuity of the various soil types across the site. There is no laterally continuous silt unit that separates water-bearing units and the fill unit and upper alluvial deposits appear to act as a single water-bearing unit (Hahn and Associates, 2002).
- Measured groundwater elevations have ranged from approximately 18 to 31 feet below ground surface (bgs) (Bridgewater Group, 2002, 2003a and 2004).
- Groundwater elevations are highest near the interior of Swan Island, and decrease to the north toward Swan Island Lagoon and to the west and south toward the Willamette River. The measured water levels indicate that the direction of groundwater flow is radially outward towards the river and the Lagoon (Bridgewater Group, 2002, 2003a and 2004).
- The depth to groundwater varies seasonally in response to precipitation and daily in response to river level fluctuations. Water levels in most of the monitoring wells respond to changes in river elevation indicating that there is a hydraulic connection. It is uncertain why water levels in several of the monitoring wells do not show the same response. Potential explanations include the fact that one of the monitoring wells (MW-2) appears to be installed in one of the former shipways that were located at the west end of the shipyard. The shipways were constructed of closely-spaced, wooden pilings driven along each side of the shipway. During the late 1940s and through part of the 1950s, the five southernmost shipways were abandoned

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in place by filling with dredged materials. It is possible that hydraulic communication between MW-2 and the Willamette River is limited by the wooden pilings that were abandoned in place and by the placement of finer-grained dredged materials at the end of the former shipway. Another explanation is that one or more of the wells are located in former lakes, ponds, or seasonally inundated lowlands that were present on Swan Island before it was filled. It is possible that suspended sediments settled and partially sealed the bottoms of these former low-lying areas. This could explain why MW-2, MW-4 and MW-9 do not respond to river level fluctuations. Finally, MW-8 and MW-9 are located farther away from the shoreline than the other monitoring wells, near the top of an apparent groundwater divide (Bridgewater Group, 2003b).

- A groundwater seep was observed at the base of the riverbank over silty/clay soil. It was approximately 20 feet long and 3 feet wide above rocky beach above high tide level.

10. NATURE AND EXTENT *(Current Understanding)*

The current understanding of the nature and extent of contamination for the uplands portions of the site is summarized in this section. When no data exist for a specific medium, a notation is made.

10.1. Soil

10.1.1. Upland Soil Investigations ☒ Yes ☐ No

The nature and extent of upland soil contamination is documented in Bridgewater Group (2001 and 2002). Soil investigations have been performed in all of the known and suspected source areas identified in the DEQ-approved RI/FS work plan (Bridgewater Group, 2000), including the BWTP area; WSI storage area; Building 73 area; Building 43, 50 and 80 area; Building 4 area; Building 58 area; paint shed/blast booth area; electrical substations; and N. Channel Avenue Fabrication site. Of these, the six outdoor substations and, possibly, the small localized area near the east end of the N. Channel Avenue Fabrication site have potentially complete pathways for constituent migration via stormwater runoff to the river. Soil sampling locations are shown in the supplemental figure entitled Soil and Groundwater Sampling Locations, Portland Shipyard Remedial Investigation adapted from Figure 3 in Bridgewater Group [2001]). Maximum detected constituent concentrations detected in surface or near-surface (i.e., 2-foot bgs), including metals concentrations that exceed literature-based background concentrations for Clark County, Washington (Ecology, 1994), are summarized for these source areas. Note that most of the soil sampling performed as part of the RI has focused on surface and near-surface soils. Relatively deep subsurface samples were also collected just above the water table.

Source Area	Constituent	Maximum Detected Concentration
Electrical Substations	Diesel-range TPH	250 mg/kg
	Oil-range TPH	1,700 mg/kg
	Aroclor 1254	0.12 mg/kg
	Aroclor 1260	0.21 mg/kg
	Naphthalene	54 ug/kg
	2-Methylnaphthalene	54 ug/kg
	Acenaphthylene	54 ug/kg
	Acenaphthene	54 ug/kg

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	Dibenzofuran	54 ug/kg
	Phenanthrene	180 ug/kg
	Anthracene	54 ug/kg
	Fluoranthene	460 ug/kg
	Pyrene	380 ug/kg
	Benzo(a)anthracene	220 ug/kg
	Chrysene	350 ug/kg
	Benzo(b)fluoranthene	320 ug/kg
	Benzo(k)fluoranthene	280 ug/kg
	Benzo(a)pyrene	270 ug/kg
	Indeno(1,2,3-cd)pyrene	250 ug/kg
	Dibenz(a,h)anthracene	54 ug/kg
	Benzo(g,h,i)perylene	230 ug/kg

Source Area	**Constituent**	**Maximum Detected Concentration**
	Arsenic	3.6 mg/kg
	Chromium	28.8 mg/kg
	Copper	48.2 mg/kg
	Lead	13.7 mg/kg
	Nickel	35 mg/kg
	Mercury	0.04 mg/kg
	Zinc	231 mg/kg
	Diesel-range TPH	6,500 mg/kg
	Oil-range TPH	3,010 mg/kg
	Acetone	170 ug/kg
	Aroclor 1260	0.017 mg/kg
	2-Methylnaphthalene	160 ug/kg
	Acenaphthene	30 ug/kg
	Dibenzofuran	150 ug/kg
	Fluorene	280 ugkg
	Phenanthrene	1,500 ug/kg
	Pyrene	990 ug/kg
	Benzo(a)anthracene	21 ug/kg
	Chrysene	82 ug/kg
	Benzo(b)fluoranthene	56 ug/kg
	Benzo(k)fluoranthene	38 ug/kg
	Benzo(a)pyrene	7.5 ug/kg
	Indeno(1,2,3-cd)pyrene	84 ug/kg
	Dibenz(a,h)anthracene	8.6 ug/kg
	Benzo(g,h,i)perylene	97 ug/kg

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10.1.2. Riverbank Samples ☐ Yes ☒ No

10.1.3. Summary

There are no known contaminated overland transport pathways from the site to the river. The potential source areas located on the portion of the site that is owned by Cascade General are almost entirely paved with asphalt or concrete or covered with buildings. The only exception is several substations that are unpaved but covered with gravel. The portion of the site that is owned by the Port is partially paved with asphalt; the remainder of the Port-owned property is unpaved and undeveloped, but does not drain to the Willamette River, except in one localized area. There is no evidence of riverbank erosion along the limited portions of shoreline that are not covered with piers, berths, and other structures.

10.2. Groundwater

10.2.1. Groundwater Investigations ☒ Yes ☐ No

In late 2001 eleven monitoring wells were installed at the site (see supplemental entitled Groundwater Monitoring Well Locations, PSY RI/FS, 2003 Annual Groundwater Sampling Results adapted from Figure 3 in Bridgewater Group [2004]). The wells were sampled quarterly in December 2001, April 2002, July 2002 and October 2002. Based on a review of the quarterly sampling results, DEQ requested that the wells be sampled using low-flow techniques. Low flow sampling was performed in March 2003 (Bridgewater Group, 2003a). Based on the low-flow sampling results, DEQ requested that subsequent annual groundwater monitoring be performed using low-flow sampling methods for selected parameters. The first round of annual groundwater samples was collected in late 2003 (Bridgewater Group, 2004).

10.2.2. NAPL (Historic & Current) ☐ Yes ☒ No

No NAPL has been observed in any monitoring wells at the site.

10.2.3. Dissolved Contaminant Plumes ☒ Yes ☐ No

Plume characterization status – complete/incomplete

The RI is still ongoing and, therefore, plume characterization is incomplete.

Plume Extent

The maximum concentrations of all metals, VOCs and PAHs detected during the first and latest round of annual groundwater sampling performed in December of 2003 are below DEQ Level II Screening Level Values (SLVs) and Ambient Water Quality Criteria (AWQC) for fish protection and fish consumption only (Bridgewater Group, 2004), except for arsenic, carbon disulfide and TCE (see supplemental Tables 2, 3 and 4 from Bridgewater Group [2004]). Total arsenic was detected above its AWQC for fish consumption only in MW-1, MW-3, MW-7 and MW-11. Carbon disulfide was detected for the first time in MW-4 in a duplicate sample above its SLV. The initial sample

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collected from MW-4 did not contain a detectable concentration of carbon disulfide, at a detection limit of 0.5 ug/L, and carbon disulfide has never been detected in other groundwater samples. TCE was also detected at MW-4 at concentrations that exceed its human health AWQC in December of 2003.

Min/Max Detections (Current situation)

The following summarizes minimum and maximum concentrations for groundwater samples collected from all monitoring wells for the first and latest (i.e., December 2003) round of annual groundwater sampling. The samples were collected using low-flow sampling techniques approved by DEQ. DEQ has not identified TPH as a parameter of interest for groundwater sampling at the site. Thus, groundwater samples have not analyzed for TPH. Selected groundwater samples were analyzed for dissolved metals concentrations during the October 2002 quarterly sampling event and during the March 2003 low flow sampling event. DEQ did not require the analysis of samples for dissolved metals during the 2003 annual groundwater sampling event.

	Minimum	Maximum	Detection Limits
Total Antimony	< 0.1 ug/L	0.1 ug/L	0.1 ug/L
Total Arsenic	<1 ug/L	10.5 ug/L	1 ug/L
Total Cadmium	0.07 ug/L	0.21 ug/L	0.05 ug/L
Total Chromium	<0.4 ug/L	1.6 ug/L	0.4 ug/L
Total Copper	0.46N ug/L	2.2N ug/L	0.2 ug/L
Total Lead	<0.04 ug/L	0.36 ug/L	0.04 ug/L
Total Nickel	2.2 ug/L	19.1 ug/L	0.2 ug/L
Total Zinc	1 ug/L	2.0 ug/L	1 ug/L
Carbon Disulfide	<0.5 ug/L	1.4 ug/L[1]	0.5 ug/L
Cis-1,2-Dichloroethene	0.93 ug/L	0.98 ug/L	0.5 ug/L
Trichloroethylene	54 ug/L	56 ug/L	0.5 ug/L
Naphthalene	0.022 ug/L	0.026 ug/L	0.02 ug/L
Phenanthrene	0.32 ug/L	0.032 ug/L	0.019 ug/L

N = matrix spike was outside control criteria

[1] Concentration detected in duplicate sample. Carbon disulfide was not detected in first sample or in any other groundwater samples.

Current Plume Data

Plume Map

No dissolved contaminant plume(s) have been identified at the site.

As is indicated in attached Tables 2, 3 and 4 from Bridgewater Group (2004), total arsenic exceeded its ambient water quality criteria for human health protection due to organism construction in samples collected from MW-1, MW-3, MW-7 and MW-11, but not MW-6. Natural background is the likely source of the arsenic. There is no evidence of an upland arsenic source or sources given that arsenic concentrations in soil are generally at or below background, except for one small area on the N. Channel Avenue

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fabrication site (Bridgewater Group, 2001). Thus, no plume map was developed for total arsenic.

Carbon disulfide was detected above its SLV in the duplicate sample, but not the original sample collected from MW-4 during annual groundwater monitoring in December of 2003. This is the first and only detection of carbon disulfide at the site. Future annual groundwater sampling will evaluate whether carbon disulfide is actually present in groundwater. Thus, no plume map was developed for carbon disulfide.

TCE was also detected at MW-4 at concentrations that exceed its human health AWQC. MW-4 is located near the top of a groundwater divide. Groundwater in the vicinity of MW-4 may flow to the south toward the Willamette River or north toward Swan Island Lagoon. Regardless, TCE has not been detected in any surrounding and potentially downgradient monitoring wells (i.e., MW-1, MW-3 and MW-5). Thus, the presence and extent of a TCE plume is likely to be limited.

Preferential Pathways

No known or suspected preferential groundwater migration pathways have been identified as part of the RI. Site features that may be limiting hydraulic communication between shallow groundwater and the river (e.g., former shipways; former lakes, ponds and seasonally inundated lowlands that were located on the original surface of Swan Island; and groundwater divide) may act to limit the rate of groundwater migration to the river. It is not known if the storm drain piping has the potential to serve as a preferred pathway for subsurface soil and groundwater migration at the site.

Downgradient Plume Monitoring Points (min/max detections)

See the table under the Min/Max Detections (Current Conditions) heading above. As is discussed in the 2003 annual groundwater monitoring report (Bridgewater Group, 2004), groundwater elevations are highest near MW-4, MW-8 and MW-9, near the interior of Swan Island, and decrease to the north toward Swan Island Lagoon and the west and south toward the Willamette River. Accordingly, downgradient monitoring points include the following monitoring wells located near the shoreline: MW-1, MW-3, MW-5, MW-6, MW-7, MW-10 and MW-11. It is uncertain if MW-2 represents a downgradient monitoring point because, unlike other monitoring wells located near the shoreline, it does not respond to rapidly to river level fluctuations.

Visual Seep Sample Data ☐ Yes ☒ No

None

Nearshore Porewater Data

None

GW Plume Temporal Trend

Only one round of groundwater samples has been collected using low-flow sampling methods.

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10.2.4. Summary

There are no known contaminated groundwater discharges from the site to the river. Although total antimony, total arsenic, total cadmium, total chromium, total copper, total lead, total nickel, total zinc, carbon disulfide, cis-1,2-dichloroethene, trichloroethylene, naphthalene and phenanthrene have been detected in groundwater, total arsenic, carbon disulfide and TCE are the only constituents that have been detected above DEQ SLVs or AWQC for fish protection and fish consumption only. Arsenic concentrations in soil are generally at or below background, except for one small area on the N. Channel Avenue fabrication site (Bridgewater Group, 2001). Thus, the arsenic concentrations detected in groundwater may be due to background conditions. Carbon disulfide was detected for the first time in MW-4 in a duplicate sample above its SLV. The initial sample collected from MW-4 did not contain a detectable concentration of carbon disulfide, at a detection limit of 0.5 ug/L, and carbon disulfide has never been detected in another groundwater samples. TCE has been consistently detected in groundwater at MW-4. Given the location of MW-4 near a groundwater divide it is uncertain whether groundwater in this location flows to the south toward the Willamette River or north toward Swan Island Lagoon. Regardless, TCE has not been detected in surrounding and potentially downgradient monitoring wells MW-1, MW-3 and MW-5. Therefore, the presence and extent of a TCE plume is likely to be limited. There are no known preferential groundwater migration pathways at the site.

10.3. Surface Water

10.3.1. Surface Water Investigation ☐ Yes ☒ No

10.3.2. General or Individual Stormwater Permit (Current or Past) ☒ Yes ☐ No

Stormwater on the portion of the site owned by Cascade General is collected by a series of catch basins connected to outfalls that discharge to the Willamette River and Swan Island Lagoon. Most of the outfalls drain localized areas along various berths. The remaining outfalls collect stormwater from larger, paved areas. This stormwater system is owned, operated and maintained by Cascade General under NPDES General Permit 1200-Z. Cascade General implements permit-required BMPs, which include quarterly cleaning of catch basins.

The City of Portland owns a storm sewer system that collects stormwater from a portion of the property owned by Cascade General and from N. Channel Avenue and several properties along N. Channel Avenue. The City storm sewer crosses Cascade General's property and discharges through an outfall near Berth 314. Another City storm system collects stormwater from a portion of the property owned by Cascade General and from N. Lagoon Avenue and several other properties adjacent to N. Lagoon. The City storm sewer crosses Cascade General's property and discharges through an outfall near Berth 305.

Most of the Port-owned portion of the site is unpaved and stormwater infiltrates into the ground. Exceptions include:

- The paved parking lot between the portion of the site owned by Cascade General and the N. Channel Avenue fabrication site. Stormwater from this parking lot is discharged through an outfall located near Berth 315.

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- The far eastside of the N. Channel Avenue fabrication site. One catch basin collects localized drainage and conveys it through an outfall that discharges just upstream of the site.

Stormwater discharges from the Port-owned portion of the site and from the City conveyance system are regulated under Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314 (Municipal Permit).

Permit Type	File Number	Start Date	Outfalls	Parameters/Frequency
1200-Z (Cascade General-owned portion of site)		8/9/02	Not specified	Total copper, lead and zinc; pH, TSS, oil and grease, floating solids, and oil and grease sheen/twice per year except floating solids and oil and grease sheen which is once a month
MS4 (Permit No. 101314)	108015	September 7, 1995	Not specified	

Do other non-stormwater wastes discharge to the system? ☐ Yes ☒ No

10.3.3. Stormwater Data ☒ Yes ☐ No

Cascade General's stormwater discharges are regulated under a general permit. The Port's and the City's stormwater discharges are regulated under an MS4 permit.

10.3.4. Catch Basin Solids Data ☐ Yes ☒No

10.3.5. Wastewater Permit ☒ Yes ☐ No

Wastewater discharge is permitted under the NPDES Waste Discharge Permit No. 101393. Waste discharges covered by the permit include treated water from the BWTP, treated dry docks stormwater and process wastewater, and untreated non-contact cooling water from ships. The permit establishes discharge limitations for Outfall 001, which conveys treated ballast water, and Outfall 002, which conveys treated dry docks stormwater and process wastewater. Since June 2003, Cascade General has not discharged treated water from Outfall 002. Instead, treated water has been discharged to the City of Portland sanitary sewer after batch monitoring. The NPDES permit was renewed on June 23, 2004. Discharges from Outfall 002 to the Willamette River are no longer permitted.

According to Bridgewater Group (2000), prior to 1996 when the Port transferred the NPDES permit to Cascade General, the "old" NPDES permit (File No. 70596) referenced three former outfalls. One was the air compressor cooling water outfall that discharged at the head of Dry Dock 3. This outfall received cooling water from four compressors that were located in Building 60. The cooling water from these compressors discharged to floor drains connected to the outfall.

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As of 1989, the four compressors had been replaced with newer units that did not require a discharge permit. The compressors were not operated after 1986 and former Outfall 001 was not used after 1986. The floor drains in Building 60 have been plugged and former Outfall 001 likely remains in place. The second was the boiler blow-down outfall that discharged to Swan Island at Berth 302. This outfall received blow-down from the steam boiler formerly located in Building 58. Discharge only occurred when the boiler was being cleaned to remove scale. When the new yard was constructed, the steam boiler was put on standby in 1986. The boiler was removed from Building 58 in 1989 and 1990. The boiler blow-down outfall likely still remains in place, but is not in use. The third outfall was the treated ballast water outfall that discharges to the Willamette River at Berth 313. This outfall is still active and is referred to in the current NPDES permit (Permit No. 101393) as Outfall 1. It receives the discharge from tanks used to hold treated ballast water for testing prior to discharge. Current Outfall 2, the treated dry dock stormwater and process wastewater outfall, also discharges to the Willamette River at the same location as current Outfall 1.

Permit Type	Permit Number	Start Date	Outfalls	Volumes	Parameters/Frequency
NPDES	101393	Expired 6/30/01 – under renewal	Outfall 1	2,650 liters/minute	pH, oil and grease, and TSS/one time per batch
			Outfall 2	None	pH, oil and grease, TSS, copper, lead, and zinc/one time per week, except for oil and grease which is one time per month during discharge periods

10.3.6. Wastewater Data

☒ **Yes** ☐ **No**

The following table summarizes wastewater data for 2003 provided by Cascade General.

		2003											
Outfall	*Parameter*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sept*	*Oct*	*Nov*	*Dec*
001	*TSS*[a]						*12.5*						
	Oil & Grease[a]						*<5*						
	Flow[b]						*659,316*						
002	*Copper*[a]	*0.007*	*0.228*	*0.0034*	*0.0034*		*0.073*						
	Lead[a]	*0.00363*	*0.008*	*0.0043*	*0.0043*		*0.006*						
	Zinc[a]	*0.146*	*0.392*	*0.251*	*0.25*		*0.639*						
	TSS[a]	*<5*	*<5*	*<5*	*<5*		*5*						
	Oil & Grease[a]	*<5*	*<5*	*<5*	*<5*		*<5*						

	Flow[b]	*573,300*	*956,676*	*631,596*	*657,468*		*445,242*						

[a] *Concentrations in mg/l*

[b] *Flow in gallons*

10.3.7. Summary

Historical releases may have occurred from outfalls that conveyed stormwater collected in upland areas where abrasive blasting, painting, material storage, and other ship repair activities occurred. Permit-required BMPs have been implemented to control potential releases associated with stormwater.

Wastewater discharges from the Ballast Water Treatment Plant (BWTP), dry dock stormwater treatment system, former air compressor, and former boiler were permitted under the facility's NPDES permit.

10.4. Sediment

10.4.1. River Sediment Data ☒ Yes ☐ No

Surface and subsurface river sediment data collected in the vicinity of the PSY 2 is summarized in Table 2. Constituents detected in surface sediment samples include Aroclor 1254, Aroclor 1260, butyltins, dioxins/furans, aluminum, antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, zinc, barium, beryllium, cobalt, tin, titanium, vanadium, PAHs, DDD, DDE, DDT, dieldrin, endrin aldehyde, Mirex, gamma-chlordane, diesel fuel, lube oil, 4-methylphenol, pentachlorophenol, phenol, dimethyl phthalate, dibutyl phthalate, butylbenzyl phthalate, di-n-octyl phthalate, bis(2-ethylhexyl) phthalate, 2,4-dinitrotoluene, benzoic acid, carbazole, dibenzofuran, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, nitrobenzene, methylethyl ketone, acetone, benzene, ethylbenzene, xylenes, chlorobenzene, and 1,4-dichlorobenzene. Constituents detected in subsurface sediments include Aroclor 1242, Aroclor 1254, Aroclor 1260, Aroclor 1232, butyltins, dioxins/furans, aluminum, antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, zinc, barium, beryllium, cobalt, tin, titanium, vanadium, PAHs, 4-methylphenol, phenol, dimethyl phthalate, diethyl phthalate, dibutyl phthalate, butylbenzyl phthalate, di-n-octyl phthalate, bis(2-ethylhexyl) phthalate, benzoic acid, carbazole, and dibenzofuran. Minimum and maximum constituent concentrations are summarized in Table 2.

10.4.2. Summary

See Final CSM Update.

11. CLEANUP HISTORY AND SOURCE CONTROL MEASURES

11.1. Soil Cleanup/Source Control

Since the late 1980s, a number of upland remedial activities have been conducted at the site. These activities are summarized below. Most of these activities conducted to date were related to the removal of USTs and heating oil tanks (HOTs), soils containing TPH and PCBs in the BWTP area, and sandblast grit and yard sweepings from the N. Channel Avenue fabrication site.

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Area	Activity	Year	Amounts Removed
Channel Avenue Fabrication Site	Removal of sweepings/sand containing cadmium	1993	60 CY
BWTP	Removal of soil containing TPH and PCBs	1993/1994	90 CY
Central Utility Building (CUB)	Soil removal around heating oil UST	1998	16 CY[a]
Building 9	UST removal	1989	30 CY
Building 10 (central bay)	UST removal Removal of PCBs from floor	1989 1992	12 CY NA
Building 50	Removal of soil containing oil, diesel and Stoddard solvent	1992	61 CY
Building 58	UST removal	1989	228 CY
Berth 305	UST removal	1989	190 CY

[a] Does not include soil removed in 1994
CY = cubic yards
UD = undocumented
NA = not applicable

In 1993, a release of heating oil was discovered in the concrete vault containing the two, 20,000-gallon HOTs near the CUB. This release was reported to DEQ on April 20, 1993. Two soil investigations were conducted in 1993, and in early 1994 most of the soil containing petroleum hydrocarbons was removed and a concrete floor was poured in the bottom of the vault. In 1994, the Port conducted a site investigation to investigate potential groundwater impacts from the heating oil release. Three soil borings were completed to a depth of 27.5 feet and two more soil borings were completed to a depth of 15 feet near the westernmost HOT. Temporary well points were installed in the three deep borings for purposes of sampling groundwater. Low to non-detectable levels of TPH (i.e., less than 9 mg/kg) were detected in soil samples collected between 15 and 27 feet bgs. No BTEX was detected, at detection limits of 2 ug/L, and no TPH was detected, at detection limits of 0.5 ug/L, in groundwater. In 1997, two soil borings were completed for purposes of collecting soil samples for constituent analysis. Approximately 1.5 CY of inaccessible soils with residual contamination were left in place. Ten soil samples were collected from the excavation and six were analyzed for TPH and PAHs (Bridgewater Group, 2000). In 2000, the Port submitted a report to DEQ documenting the site investigation and soil removal activities, as well as a risk-based assessment for the soils left in place. The risk-based assessment results indicate that PAH concentrations in soil are below DEQ's 1999 risk-based concentrations for petroleum contaminated sites (Hart Crowser, 2000).

11.2. Groundwater Cleanup/Source Control

No groundwater cleanup activities have been required or performed at the site.

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11.3. Other

Cascade General implements a series of BMPs at the shipyard, including quarterly cleaning of catch basins, under its government agency approved permits.

11.4. Potential for Recontamination from Upland Sources

Cascade General continues to perform ship repair and other industrial activities on a portion of the site. BMPs are implemented to control potential releases associated with over water activities and stormwater discharges. Treated ballast water, dry dock stormwater and process wastewater, and untreated non-contact cooling water from the BWTP are discharged under an NPDES permit.

Residual soil contamination is present but in areas that are either paved or covered with buildings, or are located in unpaved areas that do not drain to the Willamette River.

There are no known contaminated groundwater discharges from the site to the river.

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Figures:

Tables:

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FIGURES

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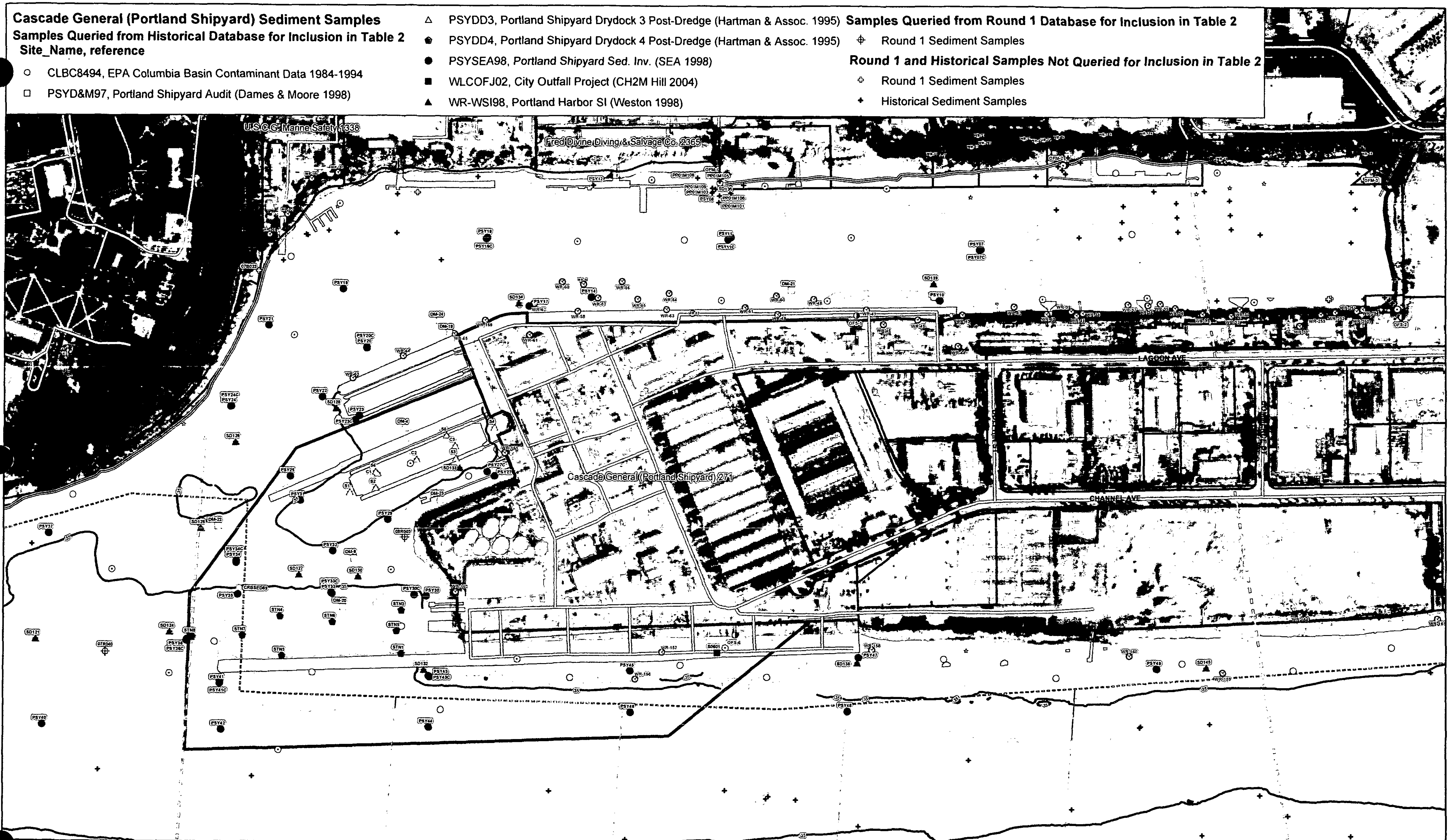

Map Document: (C:\GIS\Projects\Portland_Harbor\LWG-Map-Projects\Conseptual_Site_Model\Sample_Locations.mxd)
Plot Date: 08/19/2004
Areal Photo Date: October 2001.
Base Map features from Portland Metro's RLIS.
The City of Portland Outfall mapping information is based on available records; no warranty, expressed or implied, is provided as to the completeness or accuracy of the information. Current layer updated June 2004.

Outfalls (private)
City Outfalls
City Outfalls (Abandoned)
Seep Photo Location (Not location of actual Seep)

River Miles
Navigation Channel
-35ft. Contour (NAVD 88)
Docks & In-water Structures
Selected ECSI Site Property Boundary

Human Use Areas
Dockside Worker
Recreational Beach Use
Transient

LWG Round 2 Proposed Sediment Samples
Surface Sample Only
Core & Surface Sample

0 150 300 600 Feet

DRAFT
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Figure 1
Portland Harbor RI/FS
Conceptual Site Model
Cascade General
(Portland Shipyard)
ECSI 271

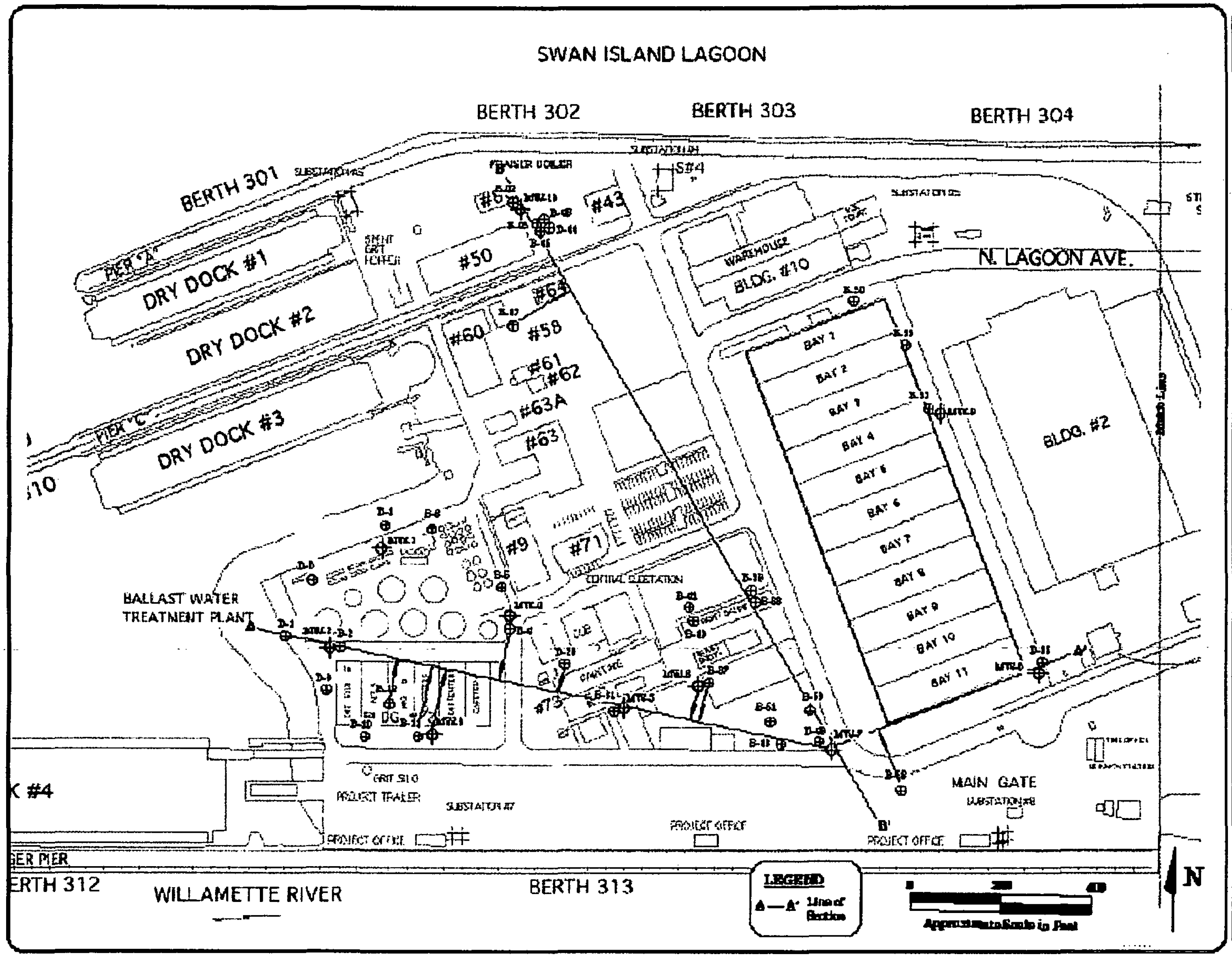

Figure 1

Lines of Cross Section

Portland Ship Yard
5555 N. Channel Avenue
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

October 2002

Project No. 4800

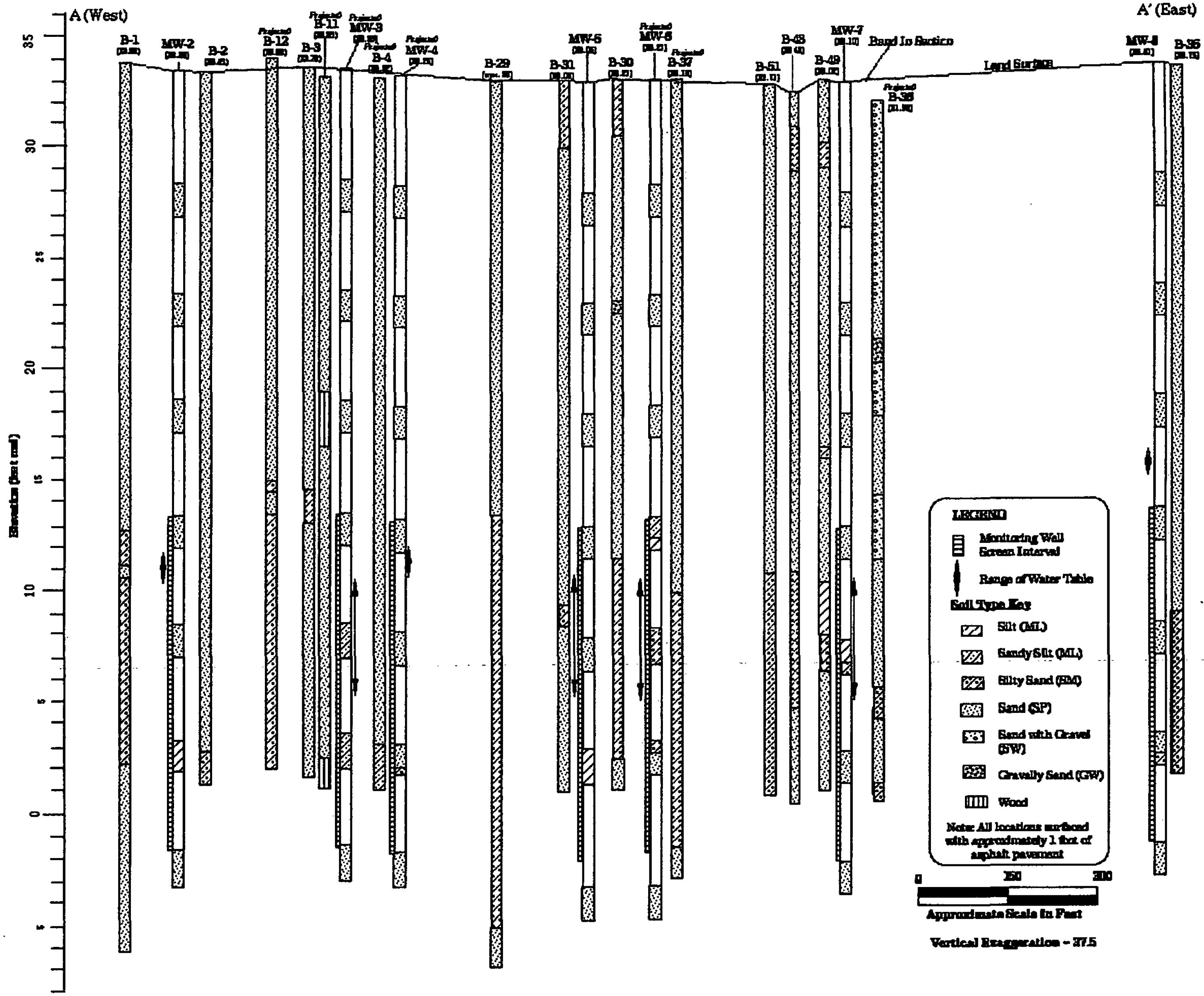

Figure 2

Cross Section A-A'

Portland Ship Yard
5555 N. Channel Avenue
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
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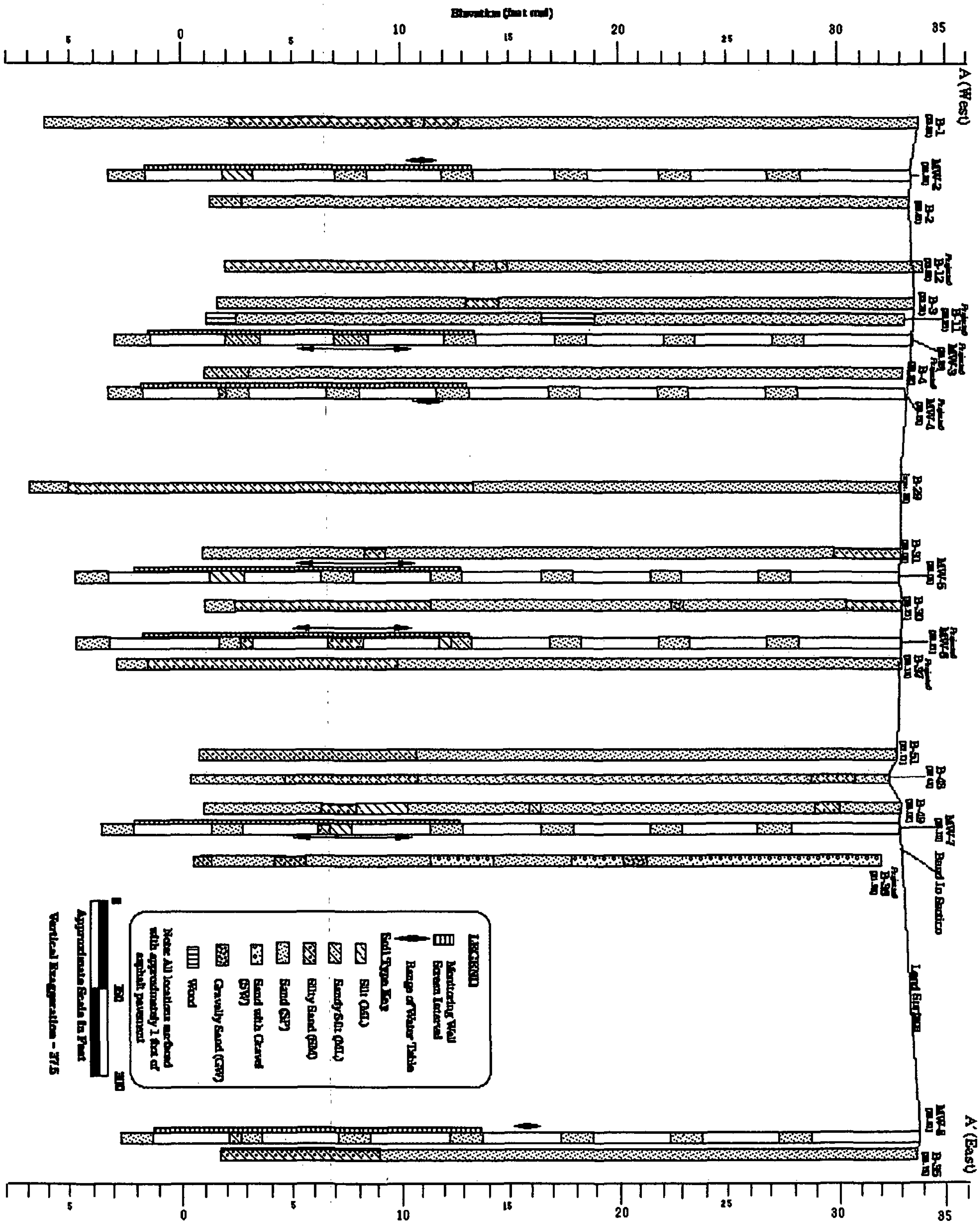
October 2002

Project No. 4800



Project No. 4800	October 2002	**HAHN AND ASSOCIATES, INC.** ENVIRONMENTAL CONSULTANTS 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	**Cross Section A-A'** Portland Ship Yard 5555 N. Channel Avenue Portland, Oregon	**Figure 2**

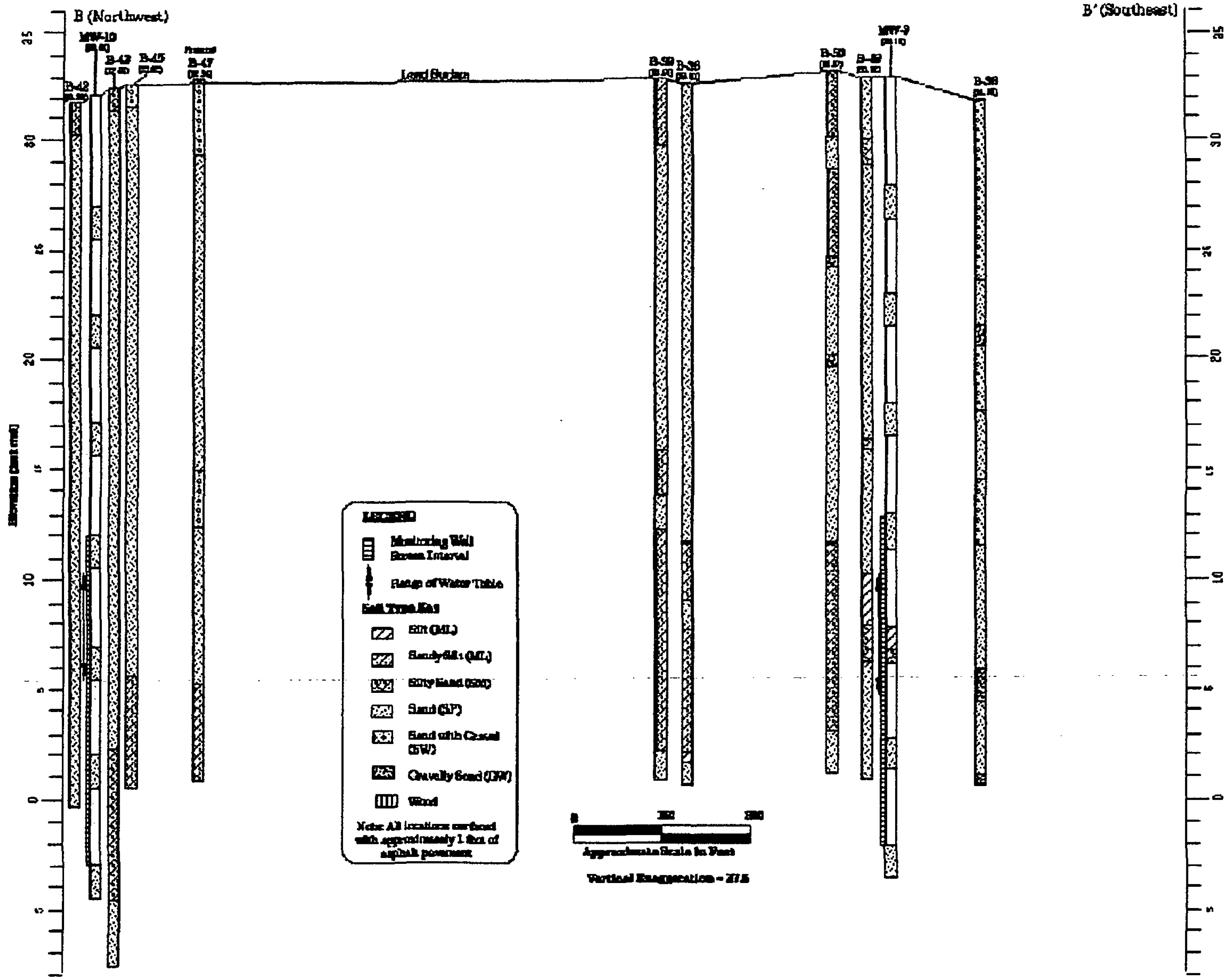


Figure 3

Cross Section B-B'

Portland Ship Yard
5555 N. Channel Avenue
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
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October 2002

Project No. 4800

TABLES

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LWG
Lower Willamette Group

Cascade General Ship Repair Yard #271

Table 1. Potential Sources and Transport Pathways Assessment

Last Updated: September 15, 2004

Potential Sources	Media Impacted					COIs																		Potential Complete Pathway				
						TPH			VOCs																			
Description of Potential Source	Surface Soil	Subsurface Soil	Groundwater	Catch Basin Solids	River Sediment	Gasoline-Range	Diesel - Range	Heavier - Range	Petroleum-Related (e.g. BTEX)	VOCs	Chlorinated VOCs	SVOCs	PAHs	Phthalates	Phenolics	Metals	PCBs	Herbicides and Pesticides	Dioxins/Furans	Butyltins	[Others -List]	[Others -List]	[Others -List]	Overland Transport	Groundwater	Direct Discharge - Overwater	Direct Discharge - Storm/Wastewater	Riverbank Erosion
Upland Areas																												
A																												
Paint Shed/Blast Booth area		√					√	√					√			√											√	
BWTP		√					√	√					√			√	√								?		√	
Building 43, 50 and 80 area		√											√			√												
Building 73		√											√			√											√	
Building 4		√														√												
WSI Storage area		√											√			√												
Substations	√	√					√	√					√				√										√	
Building 58		√											√			√												
USTs		√					√	√					√															
N. Channel Avenue fabrication site	√	√					√	√		√			√			√	√							?			?	
Overwater Areas																												
B																												
Dry docks					√								√	√		√				√						√		
Berths 302, 303, 304, 305, 312, 313, 314 and 315					√								√	√		√				√						√		
Other Areas/Other Issues																												

Notes:
[1] All information provided in this table is referenced in the site summaries. If information is not available or inconclusive, a ? may be used, as appropriate. No new information is provided in this table.
✓ = Source, COI are present or current or historic pathway is determined to be complete or potentially complete.
? = There is not enough information to determine if source or COI is present or if pathway is complete.
Blank = Source, COI and historic and current pathways have been investigated and shown to be not present or incomplete.

UST	Underground storage tank
AST	Above-ground storage tank
TPH	Total petroleum hydrocarbons
VOCs	Volatile organic compounds
SVOCs	Semivolatile organic compounds
PAHs	Polycyclic aromatic hydrocarbons
BTEX	Benzene, toluene, ethylbenzene, and xylenes
PCBs	Polychorinated biphenols

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations: Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations: Minimum	Maximum	Mean	Median	95th
surface	Aroclor 1016 (ug/kg)		59	0	0						3.9 U	200 U	33.1	10 U	100 U
surface	Aroclor 1242 (ug/kg)		59	0	0						3.9 U	200 U	33.1	10 U	100 U
surface	Aroclor 1248 (ug/kg)		59	0	0						3.9 U	200 U	33.1	10 U	100 U
surface	Aroclor 1254 (ug/kg)		58	23	39.7	11	740	219	170	510	9.4 U	740	107	20 U	460
surface	Aroclor 1260 (ug/kg)		59	22	37.3	15	2500	236	62	270	3.9 U	2500	114	20 U	200 U
surface	Aroclor 1221 (ug/kg)		59	0	0						7.8 U	400 U	42.8	10 U	100 U
surface	Aroclor 1232 (ug/kg)		59	0	0						3.9 U	200 U	33.1	10 U	100 U
surface	Polychlorinated biphenyls (ug/kg)		60	27	45	11 A	2500 A	391	257 A	1010 A	9.4 U	2500 A	197	43 A	710 A
surface	Butyltin ion (ug/kg)		16	8	50	36 H	144 H	69.9	58 H	97	5.7 U	144 H	38.6	11.8 UH	97
surface	Butyltin ion (ug/l)		2	0	0						0.06 U	0.06 U	0.06	0.06 U	0.06 U
surface	Dibutyltin ion (ug/kg)		16	11	68.8	15 J	2020 GH	758	692 GH	1280 GH	5.7 U	2020 GH	523	368 GH	1280 GH
surface	Dibutyltin ion (ug/l)		4	1	25	0.1	0.1	0.1	0.1	0.1	0.06 U	0.1	0.07	0.06 U	0.06 U
surface	Tributyltin ion (ug/kg)		28	28	100	14	42900 H	8450	5000 J	27100 H	14	42900 H	8450	5000 J	27100 H
surface	Tributyltin ion (ug/l)		36	31	86.1	0.03	11	1.23	0.5 J	3.51	0.02 U	11	1.07	0.342	3.51
surface	Tetrabutyltin (ug/kg)		8	3	37.5	7.9	32	23	29	29	5.7 U	32	12.2	5.8 U	29
surface	Tetrabutyltin (ug/l)		4	0	0						0.02 U	0.02 U	0.02	0.02 U	0.02 U
surface	Total solids (percent)		45	45	100	27.6	82.6	42.4	38.9	56.1	27.6	82.6	42.4	38.9	56.1
surface	Total organic carbon (percent)		54	54	100	0.26	3.52	1.93	2.01	2.61	0.26	3.52	1.93	2.01	2.61
surface	Acid Volatile Sulfides (mg/kg)		33	22	66.7	1.9	434 H	42.2	9.8	84.9	1.7 U	434 H	28.7	5.2	84.9
surface	Acid Volatile Sulfides (umol/g)		4	4	100	0.00501 G	0.0315 G	0.0199	0.0115	0.0314	0.00501 G	0.0315 G	0.0199	0.0115	0.0314
surface	Total volatile solids (percent)		41	41	100	2.6	12.1	7.06	6.95	9.1	2.6	12.1	7.06	6.95	9.1
surface	Ammonia (mg/l)		33	33	100	0.35	6.77	2.04	1.75	3.88	0.35	6.77	2.04	1.75	3.88
surface	2,3,7,8-Tetrachlorodibenzo-p-dioxin (ng/kg)		1	0	0						0.135 UJ	0.135 UJ	0.135	0.135 UJ	0.135 UJ
surface	Tetrachlorodibenzo-p-dioxin (ng/kg)		1	1	100	2.11 NJ	2.11 NJ	2.11	2.11 NJ	2.11 NJ	2.11 NJ	2.11 NJ	2.11	2.11 NJ	2.11 NJ
surface	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (ng/kg)		1	1	100	0.322 NJ	0.322 NJ	0.322	0.322 NJ	0.322 NJ	0.322 NJ	0.322 NJ	0.322	0.322 NJ	0.322 NJ
surface	Pentachlorodibenzo-p-dioxin (ng/kg)		1	1	100	1.84 NJ	1.84 NJ	1.84	1.84 NJ	1.84 NJ	1.84 NJ	1.84 NJ	1.84	1.84 NJ	1.84 NJ
surface	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (ng/kg)		1	1	100	0.434 NJ	0.434 NJ	0.434	0.434 NJ	0.434 NJ	0.434 NJ	0.434 NJ	0.434	0.434 NJ	0.434 NJ
surface	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (ng/kg)		1	1	100	2.31 NJ	2.31 NJ	2.31	2.31 NJ	2.31 NJ	2.31 NJ	2.31 NJ	2.31	2.31 NJ	2.31 NJ
surface	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (ng/kg)		1	1	100	1.36 NJ	1.36 NJ	1.36	1.36 NJ	1.36 NJ	1.36 NJ	1.36 NJ	1.36	1.36 NJ	1.36 NJ
surface	Hexachlorodibenzo-p-dioxin (ng/kg)		1	1	100	15.5 NJ	15.5 NJ	15.5	15.5 NJ	15.5 NJ	15.5 NJ	15.5 NJ	15.5	15.5 NJ	15.5 NJ
surface	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (ng/kg)		1	1	100	53 NJ	53 NJ	53	53 NJ	53 NJ	53 NJ	53 NJ	53	53 NJ	53 NJ
surface	Heptachlorodibenzo-p-dioxin (ng/kg)		1	1	100	100 NJ	100 NJ	100	100 NJ	100 NJ	100 NJ	100 NJ	100	100 NJ	100 NJ
surface	Octachlorodibenzo-p-dioxin (ng/kg)		1	1	100	490 NJ	490 NJ	490	490 NJ	490 NJ	490 NJ	490 NJ	490	490 NJ	490 NJ
surface	2,3,7,8-Tetrachlorodibenzofuran (ng/kg)		1	1	100	0.431	0.431	0.431	0.431	0.431	0.431	0.431	0.431	0.431	0.431
surface	Tetrachlorodibenzofuran (ng/kg)		1	1	100	5.98 NJ	5.98 NJ	5.98	5.98 NJ	5.98 NJ	5.98 NJ	5.98 NJ	5.98	5.98 NJ	5.98 NJ
surface	1,2,3,7,8-Pentachlorodibenzofuran (ng/kg)		1	1	100	0.252 NJ	0.252 NJ	0.252	0.252 NJ	0.252 NJ	0.252 NJ	0.252 NJ	0.252	0.252 NJ	0.252 NJ
surface	2,3,4,7,8-Pentachlorodibenzofuran (ng/kg)		1	1	100	0.373 NJ	0.373 NJ	0.373	0.373 NJ	0.373 NJ	0.373 NJ	0.373 NJ	0.373	0.373 NJ	0.373 NJ
surface	Pentachlorodibenzofuran (ng/kg)		1	1	100	12 NJ	12 NJ	12	12 NJ	12 NJ	12 NJ	12 NJ	12	12 NJ	12 NJ
surface	1,2,3,4,7,8-Hexachlorodibenzofuran (ng/kg)		1	1	100	1.27 NJ	1.27 NJ	1.27	1.27 NJ	1.27 NJ	1.27 NJ	1.27 NJ	1.27	1.27 NJ	1.27 NJ
surface	1,2,3,6,7,8-Hexachlorodibenzofuran (ng/kg)		1	1	100	0.87 NJ	0.87 NJ	0.87	0.87 NJ	0.87 NJ	0.87 NJ	0.87 NJ	0.87	0.87 NJ	0.87 NJ
surface	1,2,3,7,8,9-Hexachlorodibenzofuran (ng/kg)		1	0	0						0.092 U	0.092 U	0.092	0.092 U	0.092 U
surface	2,3,4,6,7,8-Hexachlorodibenzofuran (ng/kg)		1	1	100	0.55 NJ	0.55 NJ	0.55	0.55 NJ	0.55 NJ	0.55 NJ	0.55 NJ	0.55	0.55 NJ	0.55 NJ
surface	Hexachlorodibenzofuran (ng/kg)		1	1	100	19.5 NJ	19.5 NJ	19.5	19.5 NJ	19.5 NJ	19.5 NJ	19.5 NJ	19.5	19.5 NJ	19.5 NJ
surface	1,2,3,4,6,7,8-Heptachlorodibenzofuran (ng/kg)		1	1	100	14.8 NJ	14.8 NJ	14.8	14.8 NJ	14.8 NJ	14.8 NJ	14.8 NJ	14.8	14.8 NJ	14.8 NJ
surface	1,2,3,4,7,8,9-Heptachlorodibenzofuran (ng/kg)		1	1	100	1.16 NJ	1.16 NJ	1.16	1.16 NJ	1.16 NJ	1.16 NJ	1.16 NJ	1.16	1.16 NJ	1.16 NJ
surface	Heptachlorodibenzofuran (ng/kg)		1	1	100	41.2 NJ	41.2 NJ	41.2	41.2 NJ	41.2 NJ	41.2 NJ	41.2 NJ	41.2	41.2 NJ	41.2 NJ
surface	Octachlorodibenzofuran (ng/kg)		1	1	100	29.7 NJ	29.7 NJ	29.7	29.7 NJ	29.7 NJ	29.7 NJ	29.7 NJ	29.7	29.7 NJ	29.7 NJ
surface	Gravel (percent)		38	38	100	0.01	23.37	1.52	0.12	6	0.01	23.37	1.52	0.12	6
surface	Sand (percent)		65	65	100	1.67 E	88.8	22.1	12.96 E	70.17	1.67 E	88.8	22.1	12.96 E	70.17
surface	Very coarse sand (percent)		2	2	100	0.81	1.08	0.945	0.81	0.81	0.81	1.08	0.945	0.81	0.81
surface	Coarse sand (percent)		2	2	100	1.17	8.47	4.82	1.17	1.17	1.17	8.47	4.82	1.17	1.17
surface	Medium sand (percent)		2	2	100	1.48	20.9	11.2	1.48	1.48	1.48	20.9	11.2	1.48	1.48
surface	Fine sand (percent)		2	2	100	4.47	34.3	19.4	4.47	4.47	4.47	34.3	19.4	4.47	4.47
surface	Very fine sand (percent)		2	2	100	12.1	17.4	14.8	12.1	12.1	12.1	17.4	14.8	12.1	12.1
surface	Fines (percent)		32	32	100	3.78	97.6	70.4	81.4	96.5	3.78	97.6	70.4	81.4	96.5
surface	Silt (percent)		65	65	100	2.65	91.4	65.4	72.21	85.7	2.65	91.4	65.4	72.21	85.7
surface	Coarse silt (percent)		2	2	100	7.74	25.9	16.8	7.74	7.74	7.74	25.9	16.8	7.74	7.74
surface	Medium silt (percent)		2	2	100	3.73	23	13.4	3.73	3.73	3.73	23	13.4	3.73	3.73
surface	Fine silt (percent)		2	2	100	2.55	10.8	6.68	2.55	2.55	2.55	10.8	6.68	2.55	2.55
surface	Very fine silt (percent)		2	2	100	1.27	8.78	5.03	1.27	1.27	1.27	8.78	5.03	1.27	1.27
surface	Clay (percent)		65	65	100	1.18	36	11.7	10.3	23.81	1.18	36	11.7	10.3	23.81

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	8-9 Phi clay (percent)		2	2	100	1.06	4.39	2.73	1.06	1.06	1.06	4.39	2.73	1.06	1.06
surface	9-10 Phi clay (percent)		2	2	100	0.58	2.81	1.7	0.58	0.58	0.58	2.81	1.7	0.58	0.58
surface	>10 Phi clay (percent)		2	2	100	0.61	3.95	2.28	0.61	0.61	0.61	3.95	2.28	0.61	0.61
surface	Dalapon (ug/kg)		3	0	0						2.91 U	29 U	16	16 U	16 U
surface	Dicamba (ug/kg)		3	0	0						2.97 U	3.2 U	3.09	3.1 UJ	3.1 UJ
surface	MCPA (ug/kg)		3	0	0						5.68 U	3200 U	2100	3100 U	3100 U
surface	Dichloroprop (ug/kg)		3	0	0						4.79 U	6.4 U	5.8	6.2 UJ	6.2 UJ
surface	2,4-D (ug/kg)		3	0	0						5.03 U	6.4 U	5.88	6.2 UJ	6.2 UJ
surface	Silvex (ug/kg)		3	0	0						1.5 UJ	4.85 U	2.65	1.6 U	1.6 U
surface	2,4,5-T (ug/kg)		3	0	0						1.5 UJ	9.8 U	5.74	5.93 U	5.93 U
surface	2,4-DB (ug/kg)		3	0	0						3.63 U	66 U	30.5	22 U	22 U
surface	Dinoseb (ug/kg)		3	0	0						3.1 UJ	4.15 U	3.48	3.2 U	3.2 U
surface	MCPP (ug/kg)		3	0	0						2.53 U	3200 U	2100	3100 U	3100 U
surface	Aluminum (mg/kg)		15	15	100	23300	46200	37400	37600	46100	23300	46200	37400	37600	46100
surface	Aluminum (mg/l)		4	3	75	0.03	19.4	8.63	6.47	6.47	0.02 U	19.4	6.48	0.03	6.47
surface	Antimony (mg/kg)		62	29	46.8	0.03	7 J	1.42	0.3 G	6 J	0.03	7 UJ	1.54	0.15	6 J
surface	Antimony (mg/l)		4	0	0						0.05 U	0.05 U	0.05	0.05 U	0.05 U
surface	Arsenic (mg/kg)		68	58	85.3	2.4	98	10.9	6	33	2.4	98	10.1	6	22
surface	Arsenic (mg/l)		4	4	100	0.002	0.007	0.00375	0.002	0.004	0.002	0.007	0.00375	0.002	0.004
surface	Cadmium (mg/kg)		68	65	95.6	0.1	1.53	0.407	0.3	0.9	0.00245 U	1.53	0.398	0.3	0.9
surface	Cadmium (mg/l)		4	0	0						0.002 U	0.002 U	0.002	0.002 U	0.002 U
surface	Chromium (mg/kg)		68	68	100	20.3	67.5	35.2	33.6	51.8	20.3	67.5	35.2	33.6	51.8
surface	Chromium (mg/l)		4	2	50	0.006	0.02	0.013	0.006	0.006	0.005 U	0.02	0.009	0.005 U	0.006
surface	Copper (mg/kg)		68	68	100	26.6 E	2000	251	100	1100	26.6 E	2000	251	100	1100
surface	Copper (mg/l)		4	2	50	0.045	0.134	0.0895	0.045	0.045	0.002 U	0.134	0.0458	0.002 U	0.045
surface	Lead (mg/kg)		68	68	100	9	200 G	37.8	25.3	110 G	9	200 G	37.8	25.3	110 G
surface	Lead (mg/l)		4	3	75	0.002	0.047	0.02	0.011	0.011	0.001 U	0.047	0.0153	0.002	0.011
surface	Manganese (mg/kg)		15	15	100	660	856	763	779	845	660	856	763	779	845
surface	Manganese (mg/l)		4	4	100	2.78	15.9	8.56	4.07	11.5	2.78	15.9	8.56	4.07	11.5
surface	Mercury (mg/kg)		68	60	88.2	0.03	1.5	0.196	0.1	0.86	0.03	1.5	0.179	0.08	0.66
surface	Mercury (mg/l)		4	1	25	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001 U	0.0001 U	0.0001	0.0001	0.0001 U
surface	Nickel (mg/kg)		67	67	100	17 G	594	34.3	26	33	17 G	594	34.3	26	33
surface	Nickel (mg/l)		4	2	50	0.01	0.02	0.015	0.01	0.01	0.01	0.02	0.0125	0.01 U	0.01 U
surface	Selenium (mg/kg)		15	12	80	10	20	13.8	13	18	0.133 U	20	11.1	12	18
surface	Selenium (mg/l)		4	0	0						0.001 U	0.002 U	0.0015	0.001 U	0.002 U
surface	Silver (mg/kg)		67	63	94	0.09	1.9	0.503	0.4	1.2	0.03 U	1.9	0.519	0.4	1.2
surface	Silver (mg/l)		4	1	25	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002 U	0.0003	0.00023	0.0002 U	0.0002 U
surface	Thallium (mg/kg)		12	11	91.7	6	15	9.64	9	11	5 U	15	9.25	9	11
surface	Thallium (mg/l)		4	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Zinc (mg/kg)		68	68	100	68 G	2700 L	275	161 E	683 E	68 G	2700 L	275	161 E	683 E
surface	Zinc (mg/l)		4	4	100	0.008	0.179	0.0678	0.011	0.073	0.008	0.179	0.0678	0.011	0.073
surface	Barium (mg/kg)		12	12	100	171	276	197	186	234	171	276	197	186	234
surface	Barium (mg/l)		4	4	100	0.093	0.162	0.12	0.111	0.115	0.093	0.162	0.12	0.111	0.115
surface	Beryllium (mg/kg)		12	12	100	0.59	0.8	0.674	0.7	0.8	0.59	0.8	0.674	0.7	0.8
surface	Beryllium (mg/l)		4	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Calcium (mg/kg)		12	12	100	7900 J	14400	9450	8570 J	11800 J	7900 J	14400	9450	8570 J	11800 J
surface	Calcium (mg/l)		4	4	100	31.6	124	73.3	43.2	94.2	31.6	124	73.3	43.2	94.2
surface	Cobalt (mg/kg)		12	12	100	17.7	20.6	19	18.8	20.1	17.7	20.6	19	18.8	20.1
surface	Cobalt (mg/l)		4	4	100	0.006	0.018	0.0115	0.008	0.014	0.006	0.018	0.0115	0.008	0.014
surface	Iron (mg/kg)		15	15	100	33200	55600	45200	43400	55100	33200	55600	45200	43400	55100
surface	Iron (mg/l)		4	4	100	4.88	23.3	13.7	13	13.7	4.88	23.3	13.7	13	13.7
surface	Magnesium (mg/kg)		12	12	100	6780	8560	7380	7160	7840	6780	8560	7380	7160	7840
surface	Magnesium (mg/l)		4	4	100	15	42.7	27.6	17.7	34.9	15	42.7	27.6	17.7	34.9
surface	Potassium (mg/kg)		12	12	100	1100	1520	1290	1250	1510	1100	1520	1290	1250	1510
surface	Potassium (mg/l)		4	4	100	2.9	4.4	3.58	3.1	3.9	2.9	4.4	3.58	3.1	3.9
surface	Sodium (mg/kg)		12	12	100	937	1170 J	1030	985	1140 J	937	1170 J	1030	985	1140 J
surface	Sodium (mg/l)		4	4	100	14	18.9	16.5	14.2	18.8	14	18.9	16.5	14.2	18.8
surface	Tin (mg/kg)		3	3	100	1.6 X	4.06 X	2.87	2.94 X	2.94 X	1.6 X	4.06 X	2.87	2.94 X	2.94 X
surface	Titanium (mg/kg)		10	10	100	1240	2060	1840	1890	1980	1240	2060	1840	1890	1980
surface	Vanadium (mg/kg)		12	12	100	97.8	123	107	105	119	97.8	123	107	105	119
surface	Vanadium (mg/l)		4	2	50	0.017	0.036	0.0265	0.017	0.017	0.003 U	0.036	0.0148	0.003 U	0.017

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	2-Methylnaphthalene (ug/kg)		63	16	25.4	4.1 J	189	55.5	32	110	4.1 J	189	31.4	16	110
surface	Acenaphthene (ug/kg)		67	31	46.3	4.31 J	1200	109	25.3	230	4.31 J	200000 U	3050	19 U	220
surface	Acenaphthylene (ug/kg)		67	3	4.48	11	18.8	13.9	12	12	2.4 U	200000 U	3010	10 U	64 U
surface	Anthracene (ug/kg)		67	38	56.7	4.91	4000	237	40.9	814	4.91	4000	151	22	340
surface	Fluorene (ug/kg)		67	35	52.2	2.88 J	310	89.8	33	260	2.88 J	30000 U	503	19 U	230
surface	Naphthalene (ug/kg)		67	28	41.8	9.84	148	44.8	27	120	6.7 U	100000 U	1520	19 U	120
surface	Phenanthrene (ug/kg)		67	65	97	11.3	10000	461	109	1300	10 U	10000	448	102	1300
surface	Low Molecular Weight PAH (ug/kg)		67	65	97	19 A	14000 A	721	195 A	2274 A	10 UA	14000 A	700	163 A	2274 A
surface	Dibenz(a,h)anthracene (ug/kg)		67	26	38.8	12	10000	422	28.5	85	2.4 U	10000	179	19 U	78
surface	Benz(a)anthracene (ug/kg)		67	64	95.5	15	5000	240	98	610	10 U	5000	230	93	610
surface	Benzo(a)pyrene (ug/kg)		67	65	97	19	6000	253	92.8	560	10 U	6000	245	92	560
surface	Benzo(b)fluoranthene (ug/kg)		58	56	96.6	15	7000	297	95	600	10 U	7000	288	82	600
surface	Benzo(g,h,i)perylene (ug/kg)		67	60	89.6	11	9000	246	69	290	10 U	9000	223	61	270
surface	Benzo(k)fluoranthene (ug/kg)		58	55	94.8	10	3000	170	83	370	10 U	3000	162	75.1	370
surface	Chrysene (ug/kg)		67	66	98.5	17	6000	292	128	590	10 U	6000	288	128	590
surface	Fluoranthene (ug/kg)		67	66	98.5	29.7	20000	730	301	1400	10 U	20000	719	301	1400
surface	Indeno(1,2,3-cd)pyrene (ug/kg)		67	64	95.5	12	6000	202	73	310	10 U	6000	194	68	310
surface	Pyrene (ug/kg)		67	65	97	31	2000	376	300	1000	10 U	10000 U	514	300	1100
surface	Benzo(b+k)fluoranthene (ug/kg)		65	63	96.9	22 A	10000 A	489	245 A	900	10 UA	10000 A	474	234 A	900
surface	High Molecular Weight PAH (ug/kg)		67	66	98.5	110 A	72000 A	2930	1260 A	5640 A	10 UA	72000 A	2890	1260 A	5640 A
surface	Polycyclic Aromatic Hydrocarbons (ug/kg		65	64	98.5	132 A	86000 A	3730	1501 A	7813 A	10 UA	86000 A	3670	1501 A	7813 A
surface	2-Chlorobiphenyl (ng/kg)		1	1	100	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6
surface	2-Chlorobiphenyl (ug/kg)		1	0	0						60 U	60 U	60	60 U	60 U
surface	3-Chlorobiphenyl (ng/kg)		1	1	100	9.73	9.73	9.73	9.73	9.73	9.73	9.73	9.73	9.73	9.73
surface	3-Chlorobiphenyl (ug/kg)		1	0	0						60 U	60 U	60	60 U	60 U
surface	4-Chlorobiphenyl (ng/kg)		1	1	100	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
surface	4-Chlorobiphenyl (ug/kg)		1	0	0						60 U	60 U	60	60 U	60 U
surface	2,2'-Dichlorobiphenyl (ng/kg)		1	1	100	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8
surface	2,2'-Dichlorobiphenyl (ug/kg)		1	0	0						60 U	60 U	60	60 U	60 U
surface	2,3-Dichlorobiphenyl (ng/kg)		1	1	100	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
surface	2,3-Dichlorobiphenyl (ug/kg)		1	1	100	350	350	350	350	350	350	350	350	350	350
surface	2,3'-Dichlorobiphenyl (ng/kg)		1	1	100	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
surface	2,4-Dichlorobiphenyl (ng/kg)		1	1	100	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
surface	2,4'-Dichlorobiphenyl (ng/kg)		1	1	100	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6
surface	2,4'-Dichlorobiphenyl (ug/kg)		1	0	0						0.49 U	0.49 U	0.49	0.49 U	0.49 U
surface	2,5-Dichlorobiphenyl (ng/kg)		1	1	100	4	4	4	4	4	4	4	4	4	4
surface	2,6-Dichlorobiphenyl (ng/kg)		1	1	100	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23
surface	3,3'-Dichlorobiphenyl (ng/kg)		1	1	100	19	19	19	19	19	19	19	19	19	19
surface	3,4-Dichlorobiphenyl (ng/kg)		1	1	100	6.74 CJ	6.74 CJ	6.74	6.74 CJ	6.74 CJ	6.74 CJ	6.74 CJ	6.74	6.74 CJ	6.74 CJ
surface	3,4'-Dichlorobiphenyl (ng/kg)		1	0	0						C12	C12	C12	C12	C12
surface	3,5-Dichlorobiphenyl (ng/kg)		1	1	100	0.198	0.198	0.198	0.198	0.198	0.198	0.198	0.198	0.198	0.198
surface	4,4'-Dichlorobiphenyl (ng/kg)		1	1	100	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
surface	2,2',3-Trichlorobiphenyl (ng/kg)		1	1	100	40	40	40	40	40	40	40	40	40	40
surface	2,2',4-Trichlorobiphenyl (ng/kg)		1	1	100	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8
surface	2,2',5-Trichlorobiphenyl (ng/kg)		1	1	100	94.3 CJ	94.3 CJ	94.3	94.3 CJ	94.3 CJ	94.3 CJ	94.3 CJ	94.3	94.3 CJ	94.3 CJ
surface	2,2',5-Trichlorobiphenyl (ug/kg)		1	0	0						0.48 U	0.48 U	0.48	0.48 U	0.48 U
surface	2,2',6-Trichlorobiphenyl (ng/kg)		1	1	100	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6
surface	2,3,3'-Trichlorobiphenyl (ng/kg)		1	1	100	190 CJ	190 CJ	190	190 CJ	190 CJ	190 CJ	190 CJ	190	190 CJ	190 CJ
surface	2,3,4-Trichlorobiphenyl (ng/kg)		1	1	100	95.2 CJ	95.2 CJ	95.2	95.2 CJ	95.2 CJ	95.2 CJ	95.2 CJ	95.2	95.2 CJ	95.2 CJ
surface	2,3,4'-Trichlorobiphenyl (ng/kg)		1	1	100	48	48	48	48	48	48	48	48	48	48
surface	2,3,5-Trichlorobiphenyl (ng/kg)		1	1	100	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236
surface	2,3,6-Trichlorobiphenyl (ng/kg)		1	1	100	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
surface	2,3',4-Trichlorobiphenyl (ng/kg)		1	1	100	15	15	15	15	15	15	15	15	15	15
surface	2,3',5-Trichlorobiphenyl (ng/kg)		1	1	100	29.3 CJ	29.3 CJ	29.3	29.3 CJ	29.3 CJ	29.3 CJ	29.3 CJ	29.3	29.3 CJ	29.3 CJ
surface	2,3',6-Trichlorobiphenyl (ng/kg)		1	1	100	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78	8.78
surface	2,4,4'-Trichlorobiphenyl (ng/kg)		1	0	0						C20	C20	C20	C20	C20
surface	2,4,4'-Trichlorobiphenyl (ug/kg)		1	0	0						0.3 U	0.3 U	0.3	0.3 U	0.3 U
surface	2,4,5-Trichlorobiphenyl (ng/kg)		1	0	0						C26	C26	C26	C26	C26
surface	2,4,6-Trichlorobiphenyl (ng/kg)		1	0	0						C18	C18	C18	C18	C18
surface	2,4',5-Trichlorobiphenyl (ng/kg)		1	1	100	155	155	155	155	155	155	155	155	155	155
surface	2,4',6-Trichlorobiphenyl (ng/kg)		1	1	100	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	2,3',4'-Trichlorobiphenyl (ng/kg)		1	0	0						C21	C21	C21	C21	C21
surface	2,3',5'-Trichlorobiphenyl (ng/kg)		1	1	100	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87
surface	3,3',4-Trichlorobiphenyl (ng/kg)		1	1	100	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35
surface	3,3',5-Trichlorobiphenyl (ng/kg)		1	1	100	0.443	0.443	0.443	0.443	0.443	0.443	0.443	0.443	0.443	0.443
surface	3,4,4'-Trichlorobiphenyl (ng/kg)		1	1	100	67.4	67.4	67.4	67.4	67.4	67.4	67.4	67.4	67.4	67.4
surface	3,4,5-Trichlorobiphenyl (ng/kg)		1	1	100	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531
surface	3,4',5-Trichlorobiphenyl (ng/kg)		1	1	100	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97
surface	2,2',3,3'-Tetrachlorobiphenyl (ng/kg)		1	1	100	242 CJ	242 CJ	242	242 CJ	242 CJ	242 CJ	242 CJ	242	242 CJ	242 CJ
surface	2,2',3,4-Tetrachlorobiphenyl (ng/kg)		1	0	0						C40	C40	C40	C40	C40
surface	2,2',3,4'-Tetrachlorobiphenyl (ng/kg)		1	1	100	149	149	149	149	149	149	149	149	149	149
surface	2,2',3,5-Tetrachlorobiphenyl (ng/kg)		1	1	100	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6
surface	2,2',3,5'-Tetrachlorobiphenyl (ng/kg)		1	1	100	928 CJ	928 CJ	928	928 CJ	928 CJ	928 CJ	928 CJ	928	928 CJ	928 CJ
surface	2,2',3,5'-Tetrachlorobiphenyl (ug/kg)		1	0	0						0.27 U	0.27 U	0.27	0.27 U	0.27 U
surface	2,2',3,6-Tetrachlorobiphenyl (ng/kg)		1	1	100	84.6 CJ	84.6 CJ	84.6	84.6 CJ	84.6 CJ	84.6 CJ	84.6 CJ	84.6	84.6 CJ	84.6 CJ
surface	2,2',3,6'-Tetrachlorobiphenyl (ng/kg)		1	1	100	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
surface	2,2',4,4'-Tetrachlorobiphenyl (ng/kg)		1	0	0						C44	C44	C44	C44	C44
surface	2,2',4,5-Tetrachlorobiphenyl (ng/kg)		1	1	100	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8
surface	2,2',4,5'-Tetrachlorobiphenyl (ng/kg)		1	1	100	710 CJ	710 CJ	710	710 CJ	710 CJ	710 CJ	710 CJ	710	710 CJ	710 CJ
surface	2,2',4,6-Tetrachlorobiphenyl (ng/kg)		1	1	100	108 CJ	108 CJ	108	108 CJ	108 CJ	108 CJ	108 CJ	108	108 CJ	108 CJ
surface	2,2',4,6'-Tetrachlorobiphenyl (ng/kg)		1	0	0						C45	C45	C45	C45	C45
surface	2,2',5,5'-Tetrachlorobiphenyl (ng/kg)		1	1	100	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
surface	2,2',5,5'-Tetrachlorobiphenyl (ug/kg)		1	0	0						0.43 U	0.43 U	0.43	0.43 U	0.43 U
surface	2,2',5,6'-Tetrachlorobiphenyl (ng/kg)		1	0	0						C50	C50	C50	C50	C50
surface	2,2',6,6'-Tetrachlorobiphenyl (ng/kg)		1	1	100	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51
surface	2,3,3',4-Tetrachlorobiphenyl (ng/kg)		1	1	100	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51
surface	2,3,3',4'-Tetrachlorobiphenyl (ng/kg)		1	1	100	282	282	282	282	282	282	282	282	282	282
surface	2,3,3',5-Tetrachlorobiphenyl (ng/kg)		1	1	100	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
surface	2,3,3',5'-Tetrachlorobiphenyl (ng/kg)		1	1	100	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65
surface	2,3,3',6-Tetrachlorobiphenyl (ng/kg)		1	1	100	46 CJ	46 CJ	46	46 CJ	46 CJ	46 CJ	46 CJ	46	46 CJ	46 CJ
surface	2,3,4,4'-Tetrachlorobiphenyl (ng/kg)		1	1	100	77.3	77.3	77.3	77.3	77.3	77.3	77.3	77.3	77.3	77.3
surface	2,3,4,5-Tetrachlorobiphenyl (ng/kg)		1	1	100	1970 CJ	1970 CJ	1970	1970 CJ	1970 CJ	1970 CJ	1970 CJ	1970	1970 CJ	1970 CJ
surface	2,3,4,6-Tetrachlorobiphenyl (ng/kg)		1	0	0						C59	C59	C59	C59	C59
surface	2,3,4',5-Tetrachlorobiphenyl (ng/kg)		1	1	100	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2
surface	2,3,4',6-Tetrachlorobiphenyl (ng/kg)		1	1	100	292	292	292	292	292	292	292	292	292	292
surface	2,3,5,6-Tetrachlorobiphenyl (ng/kg)		1	0	0						C44	C44	C44	C44	C44
surface	2,3',4,4'-Tetrachlorobiphenyl (ng/kg)		1	1	100	831	831	831	831	831	831	831	831	831	831
surface	2,3',4,4'-Tetrachlorobiphenyl (ug/kg)		1	0	0						0.25 U	0.25 U	0.25	0.25 U	0.25 U
surface	2,3',4,5-Tetrachlorobiphenyl (ng/kg)		1	1	100	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
surface	2,3',4,5'-Tetrachlorobiphenyl (ng/kg)		1	1	100	23	23	23	23	23	23	23	23	23	23
surface	2,3',4,6-Tetrachlorobiphenyl (ng/kg)		1	0	0						C49	C49	C49	C49	C49
surface	2,3',4',5-Tetrachlorobiphenyl (ng/kg)		1	0	0						C61	C61	C61	C61	C61
surface	2,3',4',6-Tetrachlorobiphenyl (ng/kg)		1	0	0						C40	C40	C40	C40	C40
surface	2,3',5,5'-Tetrachlorobiphenyl (ng/kg)		1	1	100	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
surface	2,3',5',6-Tetrachlorobiphenyl (ng/kg)		1	0	0						0.598 U	0.598 U	0.598	0.598 U	0.598 U
surface	2,4,4',5-Tetrachlorobiphenyl (ng/kg)		1	0	0						C61	C61	C61	C61	C61
surface	2,4,4',6-Tetrachlorobiphenyl (ng/kg)		1	0	0						C59	C59	C59	C59	C59
surface	2,3',4',5'-Tetrachlorobiphenyl (ng/kg)		1	0	0						C61	C61	C61	C61	C61
surface	3,3',4,4'-Tetrachlorobiphenyl (ng/kg)		1	1	100	109	109	109	109	109	109	109	109	109	109
surface	3,3',4,5-Tetrachlorobiphenyl (ng/kg)		1	0	0						0.795 U	0.795 U	0.795	0.795 U	0.795 U
surface	3,3',4,5'-Tetrachlorobiphenyl (ng/kg)		1	1	100	52.9	52.9	52.9	52.9	52.9	52.9	52.9	52.9	52.9	52.9
surface	3,3',5,5'-Tetrachlorobiphenyl (ng/kg)		1	0	0						0.728 U	0.728 U	0.728	0.728 U	0.728 U
surface	3,4,4',5-Tetrachlorobiphenyl (ng/kg)		1	1	100	3.46	3.46	3.46	3.46	3.46	3.46	3.46	3.46	3.46	3.46
surface	2,2',3,3',4-Pentachlorobiphenyl (ng/kg)		1	1	100	407	407	407	407	407	407	407	407	407	407
surface	2,2',3,3',5-Pentachlorobiphenyl (ng/kg)		1	1	100	3010 CJ	3010 CJ	3010	3010 CJ	3010 CJ	3010 CJ	3010 CJ	3010	3010 CJ	3010 CJ
surface	2,2',3,3',6-Pentachlorobiphenyl (ng/kg)		1	1	100	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090
surface	2,2',3,4,4'-Pentachlorobiphenyl (ng/kg)		1	1	100	605 CJ	605 CJ	605	605 CJ	605 CJ	605 CJ	605 CJ	605	605 CJ	605 CJ
surface	2,2',3,4,5-Pentachlorobiphenyl (ng/kg)		1	1	100	3010 CJ	3010 CJ	3010	3010 CJ	3010 CJ	3010 CJ	3010 CJ	3010	3010 CJ	3010 CJ
surface	2,2',3,4,5'-Pentachlorobiphenyl (ng/kg)		1	0	0						C86	C86	C86	C86	C86
surface	2,2',3,4,6-Pentachlorobiphenyl (ng/kg)		1	1	100	584 CJ	584 CJ	584	584 CJ	584 CJ	584 CJ	584 CJ	584	584 CJ	584 CJ
surface	2,2',3,4,6'-Pentachlorobiphenyl (ng/kg)		1	1	100	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9
surface	2,2',3,4',5-Pentachlorobiphenyl (ng/kg)		1	1	100	5540 CJ	5540 CJ	5540	5540 CJ	5540 CJ	5540 CJ	5540 CJ	5540	5540 CJ	5540 CJ

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	2,2',3,4',6-Pentachlorobiphenyl (ng/kg)		1	0	0						C88	C88	C88	C88	C88
surface	2,2',3,5,5'-Pentachlorobiphenyl (ng/kg)		1	1	100	1120	1120	1120	1120	1120	1120	1120	1120	1120	1120
surface	2,2',3,5,6-Pentachlorobiphenyl (ng/kg)		1	1	100	3770 CJ	3770 CJ	3770	3770 CJ	3770 CJ	3770 CJ	3770 CJ	3770	3770 CJ	3770 CJ
surface	2,2',3,5,6'-Pentachlorobiphenyl (ng/kg)		1	1	100	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
surface	2,2',3,5',6-Pentachlorobiphenyl (ng/kg)		1	0	0						C93	C93	C93	C93	C93
surface	2,2',3,6,6'-Pentachlorobiphenyl (ng/kg)		1	1	100	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6
surface	2,2',3,4',5'-Pentachlorobiphenyl (ng/kg)		1	0	0						C86	C86	C86	C86	C86
surface	2,2',3,4',6'-Pentachlorobiphenyl (ng/kg)		1	0	0						C93	C93	C93	C93	C93
surface	2,2',4,4',5-Pentachlorobiphenyl (ng/kg)		1	0	0						C83	C83	C83	C83	C83
surface	2,2',4,4',6-Pentachlorobiphenyl (ng/kg)		1	0	0						C93	C93	C93	C93	C93
surface	2,2',4,5,5'-Pentachlorobiphenyl (ng/kg)		1	0	0						C90	C90	C90	C90	C90
surface	2,2',4,5,5'-Pentachlorobiphenyl (ug/kg)		1	0	0						0.35 U	0.35 U	0.35	0.35 U	0.35 U
surface	2,2',4,5,6'-Pentachlorobiphenyl (ng/kg)		1	0	0						C93	C93	C93	C93	C93
surface	2,2',4,5',6-Pentachlorobiphenyl (ng/kg)		1	1	100	75.2	75.2	75.2	75.2	75.2	75.2	75.2	75.2	75.2	75.2
surface	2,2',4,6,6'-Pentachlorobiphenyl (ng/kg)		1	1	100	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.863
surface	2,3,3',4,4'-Pentachlorobiphenyl (ng/kg)		1	1	100	1410	1410	1410	1410	1410	1410	1410	1410	1410	1410
surface	2,3,3',4,4'-Pentachlorobiphenyl (ug/kg)		1	0	0						0.21 U	0.21 U	0.21	0.21 U	0.21 U
surface	2,3,3',4,5-Pentachlorobiphenyl (ng/kg)		1	0	0						0.565 U	0.565 U	0.565	0.565 U	0.565 U
surface	2,3,3',4',5-Pentachlorobiphenyl (ng/kg)		1	1	100	158 CJ	158 CJ	158	158 CJ	158 CJ	158 CJ	158 CJ	158	158 CJ	158 CJ
surface	2,3,3',4,5'-Pentachlorobiphenyl (ng/kg)		1	0	0						C86	C86	C86	C86	C86
surface	2,3,3',4,6-Pentachlorobiphenyl (ng/kg)		1	1	100	438	438	438	438	438	438	438	438	438	438
surface	2,3,3',4',6-Pentachlorobiphenyl (ng/kg)		1	1	100	5550 CJ	5550 CJ	5550	5550 CJ	5550 CJ	5550 CJ	5550 CJ	5550	5550 CJ	5550 CJ
surface	2,3,3',5,5'-Pentachlorobiphenyl (ng/kg)		1	1	100	7.22	7.22	7.22	7.22	7.22	7.22	7.22	7.22	7.22	7.22
surface	2,3,3',5,6-Pentachlorobiphenyl (ng/kg)		1	0	0						0.697 U	0.697 U	0.697	0.697 U	0.697 U
surface	2,3,3',5',6-Pentachlorobiphenyl (ng/kg)		1	0	0						C90	C90	C90	C90	C90
surface	2,3,4,4',5-Pentachlorobiphenyl (ng/kg)		1	1	100	85.3	85.3	85.3	85.3	85.3	85.3	85.3	85.3	85.3	85.3
surface	2,3,4,4',6-Pentachlorobiphenyl (ng/kg)		1	0	0						C110	C110	C110	C110	C110
surface	2,3,4,5,6-Pentachlorobiphenyl (ng/kg)		1	0	0						C85	C85	C85	C85	C85
surface	2,3,4',5,6-Pentachlorobiphenyl (ng/kg)		1	0	0						C85	C85	C85	C85	C85
surface	2,3',4,4',5-Pentachlorobiphenyl (ng/kg)		1	1	100	4470 D	4470 D	4470	4470 D	4470 D	4470 D	4470 D	4470	4470 D	4470 D
surface	2,3',4,4',5-Pentachlorobiphenyl (ug/kg)		1	0	0						0.26 U	0.26 U	0.26	0.26 U	0.26 U
surface	2,3',4,4',6-Pentachlorobiphenyl (ng/kg)		1	0	0						C86	C86	C86	C86	C86
surface	2,3',4,5,5'-Pentachlorobiphenyl (ng/kg)		1	1	100	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8
surface	2,3',4,5',6-Pentachlorobiphenyl (ng/kg)		1	1	100	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64
surface	2,3,3',4',5'-Pentachlorobiphenyl (ng/kg)		1	1	100	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5
surface	2,3',4,4',5'-Pentachlorobiphenyl (ng/kg)		1	1	100	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4
surface	2,3',4',5,5'-Pentachlorobiphenyl (ng/kg)		1	0	0						C107	C107	C107	C107	C107
surface	2,3',4',5',6-Pentachlorobiphenyl (ng/kg)		1	0	0						C86	C86	C86	C86	C86
surface	3,3',4,4',5-Pentachlorobiphenyl (ng/kg)		1	1	100	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3
surface	3,3',4,5,5'-Pentachlorobiphenyl (ng/kg)		1	1	100	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05
surface	2,2',3,3',4,4'-Hexachlorobiphenyl (ng/kg)		1	1	100	1020 CJ	1020 CJ	1020	1020 CJ	1020 CJ	1020 CJ	1020 CJ	1020	1020 CJ	1020 CJ
surface	2,2',3,3',4,4'-Hexachlorobiphenyl (ug/kg)		1	0	0						0.22 U	0.22 U	0.22	0.22 U	0.22 U
surface	2,2',3,3',4,5-Hexachlorobiphenyl (ng/kg)		1	1	100	7910 CJ	7910 CJ	7910	7910 CJ	7910 CJ	7910 CJ	7910 CJ	7910	7910 CJ	7910 CJ
surface	2,2',3,3',4,5'-Hexachlorobiphenyl (ng/kg)		1	1	100	479	479	479	479	479	479	479	479	479	479
surface	2,2',3,3',4,6-Hexachlorobiphenyl (ng/kg)		1	1	100	96	96	96	96	96	96	96	96	96	96
surface	2,2',3,3',4,6'-Hexachlorobiphenyl (ng/kg)		1	1	100	2450	2450	2450	2450	2450	2450	2450	2450	2450	2450
surface	2,2',3,3',5,5'-Hexachlorobiphenyl (ng/kg)		1	1	100	138	138	138	138	138	138	138	138	138	138
surface	2,2',3,3',5,6-Hexachlorobiphenyl (ng/kg)		1	1	100	392 CJ	392 CJ	392	392 CJ	392 CJ	392 CJ	392 CJ	392	392 CJ	392 CJ
surface	2,2',3,3',5,6'-Hexachlorobiphenyl (ng/kg)		1	1	100	2320 CJ	2320 CJ	2320	2320 CJ	2320 CJ	2320 CJ	2320 CJ	2320	2320 CJ	2320 CJ
surface	2,2',3,3',6,6'-Hexachlorobiphenyl (ng/kg)		1	1	100	817	817	817	817	817	817	817	817	817	817
surface	2,2',3,4,4',5-Hexachlorobiphenyl (ng/kg)		1	1	100	287	287	287	287	287	287	287	287	287	287
surface	2,2',3,4,4',5'-Hexachlorobiphenyl (ng/kg)		1	0	0						C129	C129	C129	C129	C129
surface	2,2',3,4,4',5'-Hexachlorobiphenyl (ug/kg)		1	0	0						0.24 U	0.24 U	0.24	0.24 U	0.24 U
surface	2,2',3,4,4',6-Hexachlorobiphenyl (ng/kg)		1	1	100	146 CJ	146 CJ	146	146 CJ	146 CJ	146 CJ	146 CJ	146	146 CJ	146 CJ
surface	2,2',3,4,4',6'-Hexachlorobiphenyl (ng/kg)		1	0	0						C139	C139	C139	C139	C139
surface	2,2',3,4,5,5'-Hexachlorobiphenyl (ng/kg)		1	1	100	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240
surface	2,2',3,4,5,6-Hexachlorobiphenyl (ng/kg)		1	0	0						0.917 U	0.917 U	0.917	0.917 U	0.917 U
surface	2,2',3,4,5,6'-Hexachlorobiphenyl (ng/kg)		1	0	0						C134	C134	C134	C134	C134
surface	2,2',3,4,5',6-Hexachlorobiphenyl (ng/kg)		1	1	100	315	315	315	315	315	315	315	315	315	315
surface	2,2',3,4,6,6'-Hexachlorobiphenyl (ng/kg)		1	1	100	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
surface	2,2',3,4',5,5'-Hexachlorobiphenyl (ng/kg)		1	1	100	1270	1270	1270	1270	1270	1270	1270	1270	1270	1270

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	2,2',3,4',5,6-Hexachlorobiphenyl (ng/kg)		1	1	100	5290 CJ	5290 CJ	5290	5290 CJ	5290 CJ	5290 CJ	5290 CJ	5290	5290 CJ	5290 CJ
surface	2,2',3,4',5,6'-Hexachlorobiphenyl (ng/kg)		1	1	100	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8
surface	2,2',3,4',5',6-Hexachlorobiphenyl (ng/kg)		1	0	0						C147	C147	C147	C147	C147
surface	2,2',3,4',6,6'-Hexachlorobiphenyl (ng/kg)		1	1	100	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4
surface	2,2',3,5,5',6-Hexachlorobiphenyl (ng/kg)		1	0	0						C135	C135	C135	C135	C135
surface	2,2',3,5,6,6'-Hexachlorobiphenyl (ng/kg)		1	1	100	5.74	5.74	5.74	5.74	5.74	5.74	5.74	5.74	5.74	5.74
surface	2,2',4,4',5,5'-Hexachlorobiphenyl (ng/kg)		1	1	100	6880 CJ	6880 CJ	6880	6880 CJ	6880 CJ	6880 CJ	6880 CJ	6880	6880 CJ	6880 CJ
surface	2,2',4,4',5,5'-Hexachlorobiphenyl (ug/kg)		1	0	0						0.3 U	0.3 U	0.3	0.3 U	0.3 U
surface	2,2',4,4',5,6'-Hexachlorobiphenyl (ng/kg)		1	0	0						C135	C135	C135	C135	C135
surface	2,2',4,4',6,6'-Hexachlorobiphenyl (ng/kg)		1	1	100	0.422	0.422	0.422	0.422	0.422	0.422	0.422	0.422	0.422	0.422
surface	2,3,3',4,4',5-Hexachlorobiphenyl (ng/kg)		1	1	100	859	859	859	859	859	859	859	859	859	859
surface	2,3,3',4,4',5'-Hexachlorobiphenyl (ng/kg)		1	1	100	169	169	169	169	169	169	169	169	169	169
surface	2,3,3',4,4',6-Hexachlorobiphenyl (ng/kg)		1	1	100	752	752	752	752	752	752	752	752	752	752
surface	2,3,3',4,5,5'-Hexachlorobiphenyl (ng/kg)		1	1	100	65.1	65.1	65.1	65.1	65.1	65.1	65.1	65.1	65.1	65.1
surface	2,3,3',4,5,6-Hexachlorobiphenyl (ng/kg)		1	0	0						C129	C129	C129	C129	C129
surface	2,3,3',4,5',6-Hexachlorobiphenyl (ng/kg)		1	0	0						0.64 U	0.64 U	0.64	0.64 U	0.64 U
surface	2,3,3',4',5,5'-Hexachlorobiphenyl (ng/kg)		1	1	100	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1
surface	2,3,3',4',5,6-Hexachlorobiphenyl (ng/kg)		1	0	0						C129	C129	C129	C129	C129
surface	2,3,3',4',5',6-Hexachlorobiphenyl (ng/kg)		1	1	100	579	579	579	579	579	579	579	579	579	579
surface	2,3,3',5,5',6-Hexachlorobiphenyl (ng/kg)		1	1	100	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41
surface	2,3,4,4',5,6-Hexachlorobiphenyl (ng/kg)		1	0	0						C128	C128	C128	C128	C128
surface	2,3',4,4',5,5'-Hexachlorobiphenyl (ng/kg)		1	1	100	321	321	321	321	321	321	321	321	321	321
surface	2,3',4,4',5',6-Hexachlorobiphenyl (ng/kg)		1	0	0						C153	C153	C153	C153	C153
surface	3,3',4,4',5,5'-Hexachlorobiphenyl (ng/kg)		1	1	100	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39
surface	2,2',3,3',4,4',5-Heptachlorobiphenyl (ng/kg)		1	1	100	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
surface	2,2',3,3',4,4',5-Heptachlorobiphenyl (ug/kg)		1	0	0						0.24 U	0.24 U	0.24	0.24 U	0.24 U
surface	2,2',3,3',4,4',6-Heptachlorobiphenyl (ng/kg)		1	1	100	674 CJ	674 CJ	674	674 CJ	674 CJ	674 CJ	674 CJ	674	674 CJ	674 CJ
surface	2,2',3,3',4,5,5'-Heptachlorobiphenyl (ng/kg)		1	1	100	357	357	357	357	357	357	357	357	357	357
surface	2,2',3,3',4,5,6-Heptachlorobiphenyl (ng/kg)		1	0	0						C171	C171	C171	C171	C171
surface	2,2',3,3',4,5,6'-Heptachlorobiphenyl (ng/kg)		1	1	100	1770	1770	1770	1770	1770	1770	1770	1770	1770	1770
surface	2,2',3,3',4,5',6-Heptachlorobiphenyl (ng/kg)		1	1	100	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7
surface	2,2',3,3',4,6,6'-Heptachlorobiphenyl (ng/kg)		1	1	100	253	253	253	253	253	253	253	253	253	253
surface	2,2',3,3',4,5',6'-Heptachlorobiphenyl (ng/kg)		1	1	100	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090
surface	2,2',3,3',5,5',6-Heptachlorobiphenyl (ng/kg)		1	1	100	371	371	371	371	371	371	371	371	371	371
surface	2,2',3,3',5,6,6'-Heptachlorobiphenyl (ng/kg)		1	1	100	652	652	652	652	652	652	652	652	652	652
surface	2,2',3,4,4',5,5'-Heptachlorobiphenyl (ng/kg)		1	1	100	3750 CJ	3750 CJ	3750	3750 CJ	3750 CJ	3750 CJ	3750 CJ	3750	3750 CJ	3750 CJ
surface	2,2',3,4,4',5,5'-Heptachlorobiphenyl (ug/kg)		1	0	0						0.21 U	0.21 U	0.21	0.21 U	0.21 U
surface	2,2',3,4,4',5,6-Heptachlorobiphenyl (ng/kg)		1	1	100	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1
surface	2,2',3,4,4',5,6'-Heptachlorobiphenyl (ng/kg)		1	1	100	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
surface	2,2',3,4,4',5',6-Heptachlorobiphenyl (ng/kg)		1	1	100	1260 CJ	1260 CJ	1260	1260 CJ	1260 CJ	1260 CJ	1260 CJ	1260	1260 CJ	1260 CJ
surface	2,2',3,4,4',6,6'-Heptachlorobiphenyl (ng/kg)		1	1	100	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48
surface	2,2',3,4,5,5',6-Heptachlorobiphenyl (ng/kg)		1	0	0						C183	C183	C183	C183	C183
surface	2,2',3,4,5,6,6'-Heptachlorobiphenyl (ng/kg)		1	1	100	0.419	0.419	0.419	0.419	0.419	0.419	0.419	0.419	0.419	0.419
surface	2,2',3,4',5,5',6-Heptachlorobiphenyl (ng/kg)		1	1	100	1860	1860	1860	1860	1860	1860	1860	1860	1860	1860
surface	2,2',3,4',5,5',6-Heptachlorobiphenyl (ug/kg)		1	0	0						0.26 U	0.26 U	0.26	0.26 U	0.26 U
surface	2,2',3,4',5,6,6'-Heptachlorobiphenyl (ng/kg)		1	1	100	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14
surface	2,3,3',4,4',5,5'-Heptachlorobiphenyl (ng/kg)		1	1	100	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7
surface	2,3,3',4,4',5,6-Heptachlorobiphenyl (ng/kg)		1	1	100	385	385	385	385	385	385	385	385	385	385
surface	2,3,3',4,4',5',6-Heptachlorobiphenyl (ng/kg)		1	1	100	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6
surface	2,3,3',4,5,5',6-Heptachlorobiphenyl (ng/kg)		1	0	0						0.267 U	0.267 U	0.267	0.267 U	0.267 U
surface	2,3,3',4',5,5',6-Heptachlorobiphenyl (ng/kg)		1	0	0						C180	C180	C180	C180	C180
surface	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (ng/kg)		1	1	100	606	606	606	606	606	606	606	606	606	606
surface	2,2',3,3',4,4',5,6-Octachlorobiphenyl (ng/kg)		1	1	100	279	279	279	279	279	279	279	279	279	279
surface	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (ng/kg)		1	1	100	390	390	390	390	390	390	390	390	390	390
surface	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (ng/kg)		1	1	100	133 CJ	133 CJ	133	133 CJ	133 CJ	133 CJ	133 CJ	133	133 CJ	133 CJ
surface	2,2',3,3',4,5,5',6-Octachlorobiphenyl (ng/kg)		1	1	100	678 CJ	678 CJ	678	678 CJ	678 CJ	678 CJ	678 CJ	678	678 CJ	678 CJ
surface	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (ng/kg)		1	0	0						C198	C198	C198	C198	C198
surface	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (ng/kg)		1	0	0						C197	C197	C197	C197	C197
surface	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (ng/kg)		1	1	100	97.2	97.2	97.2	97.2	97.2	97.2	97.2	97.2	97.2	97.2
surface	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (ng/kg)		1	1	100	116	116	116	116	116	116	116	116	116	116
surface	2,2',3,4,4',5,5',6-Octachlorobiphenyl (ng/kg)		1	1	100	445	445	445	445	445	445	445	445	445	445

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (ng/kg)		1	1	100	0.411	0.411	0.411	0.411	0.411	0.411	0.411	0.411	0.411	0.411
surface	2,3,3',4,4',5,5',6-Octachlorobiphenyl (ng/kg)		1	1	100	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7
surface	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (ng/kg)		1	1	100	222	222	222	222	222	222	222	222	222	222
surface	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (ng/kg)		1	1	100	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3
surface	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (ng/kg)		1	1	100	74	74	74	74	74	74	74	74	74	74
surface	2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (ng/kg)		1	1	100	213	213	213	213	213	213	213	213	213	213
surface	2,4'-DDD (ug/kg)		3	0	0						0.39 U	3.59 U	1.56	0.69 U	0.69 U
surface	2,4'-DDE (ug/kg)		3	0	0						0.8 U	3.59 U	2.16	2.1 U	2.1 U
surface	2,4'-DDT (ug/kg)		3	0	0						0.39 U	3.59 U	1.46	0.4 UJ	0.4 UJ
surface	4,4'-DDD (ug/kg)		19	3	15.8	1.1 J	35	14.4	7	7	0.698 U	35	4.81	3 U	9 U
surface	4,4'-DDE (ug/kg)		19	4	21.1	1.4 J	6	3.8	1.8	6	0.826 U	9 U	3.26	3 U	6
surface	4,4'-DDT (ug/kg)		19	3	15.8	1.4 J	140	49.1	6	6	0.93 U	140	10.9	3 U	9 U
surface	Total of 3 isomers: pp-DDT,-DDD,-DDE (ug/kg)		19	4	21.1	1.8	153 A	51.4	3.9 A	47 A	0.93 UA	153 A	13.9	3.9 A	47 A
surface	Aldrin (ug/kg)		19	0	0						0.2 U	200 U	53.7	1.55 U	200 U
surface	alpha-Hexachlorocyclohexane (ug/kg)		19	0	0						0.2 U	200 U	74.4	1.12 U	200 U
surface	beta-Hexachlorocyclohexane (ug/kg)		19	0	0						0.2 U	600 U	159	2 U	600 U
surface	delta-Hexachlorocyclohexane (ug/kg)		19	0	0						0.2 U	200 U	53.5	1 U	200 U
surface	gamma-Hexachlorocyclohexane (ug/kg)		19	0	0						0.2 U	200 U	53.6	1 U	200 U
surface	cis-Chlordane (ug/kg)		5	0	0						0.2 U	2 U	0.968	0.95 U	1.43 U
surface	trans-Chlordane (ug/kg)		3	0	0						0.2 U	1.46 U	0.67	0.35 U	0.35 U
surface	Oxychlordane (ug/kg)		3	0	0						0.39 U	3.59 U	1.46	0.4 U	0.4 U
surface	cis-Nonachlor (ug/kg)		3	0	0						0.39 U	3.59 U	1.46	0.4 U	0.4 U
surface	trans-Nonachlor (ug/kg)		3	0	0						0.39 U	3.59 U	1.46	0.4 U	0.4 U
surface	Dieldrin (ug/kg)		19	1	5.26	10	10	10	10	10	0.39 U	10	3.68	3 U	9 U
surface	alpha-Endosulfan (ug/kg)		6	0	0						0.2 U	6 U	1.81	0.95 U	2 U
surface	beta-Endosulfan (ug/kg)		19	0	0						0.39 U	9 U	3.27	2 U	6 U
surface	Endosulfan sulfate (ug/kg)		19	0	0						0.4 U	9 U	3.3	2 U	6 U
surface	Endrin (ug/kg)		19	0	0						0.39 U	9 U	3.26	2 U	6 U
surface	Endrin aldehyde (ug/kg)		19	1	5.26	3	3	3	3	3	0.39 U	9 U	3.59	3 U	6 U
surface	Endrin ketone (ug/kg)		5	0	0						0.39 U	2 U	1.14	1.01 U	1.9 U
surface	Heptachlor (ug/kg)		19	0	0						0.2 U	200 U	53.6	1 U	200 U
surface	Heptachlor epoxide (ug/kg)		19	0	0						0.2 U	9 U	2.93	3 U	6 U
surface	Methoxychlor (ug/kg)		19	0	0						2 U	12 U	3.71	2 U	9.5 U
surface	Mirex (ug/kg)		2	1	50	1.3	1.3	1.3	1.3	1.3	0.4 U	1.3	0.85	0.4 U	0.4 U
surface	Toxaphene (ug/kg)		19	0	0						20 U	180 U	45.1	30 U	95 U
surface	gamma-Chlordane (ug/kg)		2	1	50	5	5	5	5	5	0.95 U	5	2.98	0.95 U	0.95 U
surface	Chlordane (cis & trans) (ug/kg)		15	0	0						1 U	12 U	6.8	10 U	10 U
surface	Endosulfan (ug/kg)		13	0	0						0.9 U	9 U	3.42	4 U	6 U
surface	Diesel fuels (mg/kg)		1	1	100	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
surface	Lube Oil (mg/kg)		1	1	100	78.7	78.7	78.7	78.7	78.7	78.7	78.7	78.7	78.7	78.7
surface	2,3,4,6-Tetrachlorophenol (ug/kg)		3	0	0						24 U	99 U	73.7	98 U	98 U
surface	2,4,5-Trichlorophenol (ug/kg)		54	0	0						24 U	250 U	78	40 U	250 U
surface	2,4,6-Trichlorophenol (ug/kg)		54	0	0						24 U	100 U	49.6	30 U	99 U
surface	2,4-Dichlorophenol (ug/kg)		54	0	0						24 U	100 U	82.3	100 UG	100 U
surface	2,4-Dimethylphenol (ug/kg)		62	0	0						19 U	59 U	24.1	20 U	50 U
surface	2,4-Dinitrophenol (ug/kg)		54	0	0						120 U	300 U	264	300 UG	300 U
surface	2-Chlorophenol (ug/kg)		54	0	0						19 U	50 U	41.6	50 UG	50 U
surface	2-Methylphenol (ug/kg)		62	0	0						19 U	100 U	65.5	100 U	100 U
surface	2-Nitrophenol (ug/kg)		54	0	0						24 U	100 U	55.8	40 U	99 U
surface	4,6-Dinitro-2-methylphenol (ug/kg)		54	0	0						100 UG	250 U	142	100 U	250 U
surface	4-Chloro-3-methylphenol (ug/kg)		54	0	0						24 U	50 U	46.7	50 UG	50 U
surface	4-Methylphenol (ug/kg)		62	23	37.1	21	1400	380	420	780	20 U	1400	196	100 U	630
surface	4-Nitrophenol (ug/kg)		55	0	0						2.89 U	250 U	114	100 U	250 U
surface	Pentachlorophenol (ug/kg)		63	1	1.59	35.3 J	35.3 J	35.3	35.3 J	35.3 J	3.71 U	250 U	103	100 U	250 U
surface	Phenol (ug/kg)		62	4	6.45	24	119	62.5	52	55	19 U	119	41.7	50 U	50 U
surface	2,3,4,5-Tetrachlorophenol (ug/kg)		2	0	0						98 U	99 U	98.5	98 U	98 U
surface	2,3,5,6-Tetrachlorophenol (ug/kg)		3	0	0						24 U	99 U	73.7	98 U	98 U
surface	Dimethyl phthalate (ug/kg)		65	9	13.8	11	58	22.2	16	37	10 U	140 U	25.9	19 U	64 U
surface	Diethyl phthalate (ug/kg)		65	0	0						10 U	140 U	24.2	10 U	64 U
surface	Dibutyl phthalate (ug/kg)		65	44	67.7	11	350	53.6	30	116	10 U	350	67.9	30	250 U
surface	Butylbenzyl phthalate (ug/kg)		65	48	73.8	18 J	280	73.4	55	170	10 U	280	63.7	50 U	160

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Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Di-n-octyl phthalate (ug/kg)		65	36	55.4	12	4290	202	37	280	10 U	4290	129	34	115
surface	Bis(2-ethylhexyl) phthalate (ug/kg)		65	65	100	110	3900 B	1070	778	2220	110	3900 B	1070	778	2220
surface	Azobenzene (ug/kg)		2	0	0						20 U	20 U	20	20 U	20 U
surface	Bis(2-chloro-1-methylethyl) ether (ug/kg)		20	0	0						19 UJ	50 U	28.7	20 U	50 U
surface	2,4-Dinitrotoluene (ug/kg)		21	1	4.76	260	260	260	260	260	24 U	260	90.5	97 U	100 U
surface	2,6-Dinitrotoluene (ug/kg)		21	0	0						24 U	100 U	80.5	96 U	99 U
surface	2-Chloronaphthalene (ug/kg)		21	0	0						2.4 U	50 U	27.4	20 U	50 U
surface	2-Nitroaniline (ug/kg)		21	0	0						24 U	250 U	138	99 UJ	250 U
surface	3,3'-Dichlorobenzidine (ug/kg)		21	0	0						24 U	250 U	138	99 U	250 U
surface	3-Nitroaniline (ug/kg)		21	0	0						24 U	250 U	152	120 U	250 U
surface	4-Bromophenyl phenyl ether (ug/kg)		21	0	0						19 U	50 U	28.5	20 U	50 U
surface	4-Chloroaniline (ug/kg)		21	0	0						24 U	60 U	54.5	58 U	60 U
surface	4-Chlorophenyl phenyl ether (ug/kg)		21	0	0						19 U	50 U	28.5	20 U	50 U
surface	4-Nitroaniline (ug/kg)		21	0	0						24 U	250 U	138	99 U	250 U
surface	Aniline (ug/kg)		9	0	0						20 U	50 U	40.4	50 U	50 U
surface	Benzoic acid (ug/kg)		21	1	4.76	164 J	164 J	164	164 J	164 J	164 J	250 U	210	200 U	250 U
surface	Benzyl alcohol (ug/kg)		21	0	0						19 U	99 U	36	20 U	50 U
surface	Bis(2-chloroethoxy) methane (ug/kg)		21	0	0						19 U	50 U	28.5	20 U	50 U
surface	Bis(2-chloroethyl) ether (ug/kg)		21	0	0						24 U	50 U	41.4	39 U	50 U
surface	Carbazole (ug/kg)		21	10	47.6	7.9 M	130	63.2	60	130	7.9 M	130	40.5	20 U	74
surface	Dibenzofuran (ug/kg)		62	23	37.1	7.1	204	66.1	64	150	7.1	204	37.3	14	140
surface	Hexachlorobenzene (ug/kg)		22	2	9.09	2.7	440	221	2.7	2.7	0.2 U	440	43.3	20 U	50 U
surface	Hexachlorobutadiene (ug/kg)		28	1	3.57	230	230	230	230	230	0.2 U	230	42.2	20 U	100 U
surface	Hexachlorocyclopentadiene (ug/kg)		21	0	0						24 U	100 U	80.5	96 U	99 U
surface	Hexachloroethane (ug/kg)		22	1	4.55	210	210	210	210	210	1.8 U	210	33.3	20 U	50 U
surface	Isophorone (ug/kg)		21	0	0						19 U	50 U	28.5	20 U	50 U
surface	Nitrobenzene (ug/kg)		21	1	4.76	300	300	300	300	300	19 UJ	300	40.4	20 U	50 U
surface	N-Nitrosodimethylamine (ug/kg)		3	0	0						98 U	120 U	106	99 U	99 U
surface	N-Nitrosodipropylamine (ug/kg)		21	0	0						24 U	50 U	41.4	39 U	50 U
surface	N-Nitrosodiphenylamine (ug/kg)		21	0	0						19 U	50 U	28.5	20 U	50 U
surface	Benzidine (ug/kg)		6	0	0						250 U	250 U	250	250 U	250 U
surface	Bis(2-chloroisopropyl) ether (ug/kg)		1	0	0						24 U	24 U	24	24 U	24 U
surface	1,1,1,2-Tetrachloroethane (ug/kg)		6	0	0						5 U	50 U	26.7	25 U	50 U
surface	1,1,1-Trichloroethane (ug/kg)		12	0	0						5 U	250 U	58.8	10 U	250 U
surface	1,1,2,2-Tetrachloroethane (ug/kg)		12	0	0						5 U	250 U	58.3	10 U	250 U
surface	1,1,2-Trichloroethane (ug/kg)		12	0	0						4 U	100 U	31.8	10 U	100 U
surface	1,1-Dichloroethane (ug/kg)		12	0	0						4 U	100 U	31.8	10 U	100 U
surface	Vinylidene chloride (ug/kg)		12	0	0						4 U	100 U	31.8	10 U	100 U
surface	1,2,3-Trichloropropane (ug/kg)		6	0	0						5 U	250 U	93.3	25 U	250 U
surface	1,2-Dichloroethane (ug/kg)		12	0	0						4 U	100 U	31.8	10 U	100 U
surface	1,2-Dichloropropane (ug/kg)		12	0	0						4 U	100 U	31.8	10 U	100 U
surface	Methylethyl ketone (ug/kg)		12	1	8.33	44	44	44	44	44	20 U	1250 U	322	44	1250 U
surface	Methyl N-butyl ketone (ug/kg)		12	0	0						20 U	500 U	153	40 U	500 U
surface	Methyl isobutyl ketone (ug/kg)		12	0	0						20 U	500 U	153	40 U	500 U
surface	Acetone (ug/kg)		10	4	40	71	310	223	200	310	50 U	500 U	249	250 U	500 U
surface	Benzene (ug/kg)		12	2	16.7	4.8	7.3	6.05	4.8	4.8	4 U	100 U	32.1	10 U	100 U
surface	Bromochloromethane (ug/kg)		6	0	0						5 U	100 U	44.2	25 U	100 U
surface	Bromodichloromethane (ug/kg)		12	0	0						4 U	100 U	31.8	10 U	100 U
surface	Bromoform (ug/kg)		12	0	0						4 U	100 U	39.7	5 U	100 U
surface	Bromomethane (ug/kg)		12	0	0						5 U	500 U	179	20 U	500 U
surface	Carbon disulfide (ug/kg)		10	0	0						5 U	500 U	115	20 U	500 U
surface	Carbon tetrachloride (ug/kg)		12	0	0						5 U	250 U	58.8	10 U	250 U
surface	Chlorodibromomethane (ug/kg)		12	0	0						4 U	100 U	31.3	5 U	100 U
surface	Chloroethane (ug/kg)		12	0	0						5 U	500 U	179	20 U	500 U
surface	Chloroform (ug/kg)		12	0	0						4 U	100 U	31.8	10 U	100 U
surface	Chloromethane (ug/kg)		12	0	0						5 U	500 U	179	20 U	500 U
surface	Methylene bromide (ug/kg)		6	0	0						5 U	50 U	27.5	25 U	50 U
surface	Dichlorodifluoromethane (ug/kg)		6	0	0						5 U	500 U	178	25 U	500 U
surface	Ethylbenzene (ug/kg)		20	8	40	8	2000	431	53	1000	5 U	2000	182	12	1000
surface	Isopropylbenzene (ug/kg)		6	0	0						20 U	100 U	56.7	50 U	100 U
surface	Methylene chloride (ug/kg)		12	0	0						10 U	1000 U	233	40 U	1000 U

Table 2. Queried Sediment Chemistry Data

Surface or			Number	Number	%			Detected Concentrations					Detected and Nondetected Concentrations		
Subsurface	Analyte	Units	of Samples	Detected	Detected	Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
surface	Styrene (ug/kg)		12	0	0						5 U	250 U	58.3	10 U	250 U
surface	Tetrachloroethene (ug/kg)		20	0	0						5 U	250 U	37	5 U	250 U
surface	Toluene (ug/kg)		12	0	0						4 U	100 U	31.8	10 U	100 U
surface	trans-1,2-Dichloroethene (ug/kg)		4	0	0						5 U	25 U	16.3	10 U	25 U
surface	trans-1,3-Dichloropropene (ug/kg)		4	0	0						5 U	25 U	16.3	10 U	25 U
surface	Trichloroethene (ug/kg)		20	0	0						4 U	100 U	21.1	5 U	100 U
surface	Trichlorofluoromethane (ug/kg)		6	0	0						5 U	500 U	178	25 U	500 U
surface	Vinyl chloride (ug/kg)		12	0	0						5 U	500 U	179	20 U	500 U
surface	1,1-Dichloropropene (ug/kg)		6	0	0						5 U	50 U	27.5	25 U	50 U
surface	1,2-Dibromo-3-chloropropane (ug/kg)		6	0	0						20 U	250 U	123	100 U	250 U
surface	1,3,5-Trimethylbenzene (ug/kg)		6	0	0						20 U	100 U	56.7	50 U	100 U
surface	1,3-Dichloropropane (ug/kg)		6	0	0						5 U	50 U	27.5	25 U	50 U
surface	2,2-Dichloropropane (ug/kg)		6	0	0						5 U	50 U	27.5	25 U	50 U
surface	2-Chlorotoluene (ug/kg)		6	0	0						20 U	100 U	56.7	50 U	100 U
surface	4-Chlorotoluene (ug/kg)		6	0	0						20 U	100 U	56.7	50 U	100 U
surface	Bromobenzene (ug/kg)		6	0	0						5 U	50 U	26.7	25 U	50 U
surface	Ethylene dibromide (ug/kg)		6	0	0						20 U	100 U	56.7	50 U	100 U
surface	n-Propylbenzene (ug/kg)		6	0	0						20 U	100 U	56.7	50 U	100 U
surface	Pseudocumene (ug/kg)		6	0	0						20 U	100 U	56.7	50 U	100 U
surface	Sec-butylbenzene (ug/kg)		4	0	0						20 U	100 U	60	20 U	100 U
surface	tert-Butylbenzene (ug/kg)		4	0	0						20 U	100 U	60	20 U	100 U
surface	1,2-Dichloroethene (ug/kg)		12	0	0						5 U	250 U	58.8	10 U	250 U
surface	1,3-Dichloropropene (ug/kg)		12	0	0						4 U	100 U	31.8	10 U	100 U
surface	Butylbenzene (ug/kg)		6	0	0						20 U	100 U	56.7	50 U	100 U
surface	Cymene (ug/kg)		6	0	0						20 U	100 U	56.7	50 U	100 U
surface	Xylene (ug/kg)		20	14	70	13	3200	484	54	2300	5 U	3200	347	48	2300
surface	Chlorobenzene (ug/kg)		12	2	16.7	8.8	10	9.4	8.8	8.8	4 U	100 U	32.2	10	100 U
surface	1,2-Dichlorobenzene (ug/kg)		35	0	0						5 U	50 U	22.8	20 U	50 U
surface	1,3-Dichlorobenzene (ug/kg)		35	0	0						5 U	50 U	22.8	20 U	50 U
surface	1,4-Dichlorobenzene (ug/kg)		35	1	2.86	230	230	230	230	230	5 U	230	27.9	20 U	50 U
surface	1,2,3-Trichlorobenzene (ug/kg)		6	0	0						20 U	100 U	56.7	50 U	100 U
surface	1,2,4-Trichlorobenzene (ug/kg)		27	0	0						19 U	100 U	34.7	20 U	50 U
subsurface	Aroclor 1016 (ug/kg)		40	0	0						10 U	20 UJ	11.7	10 U	20 U
subsurface	Aroclor 1242 (ug/kg)		40	1	2.5	69 J	69 J	69	69 J	69 J	10 U	69 J	13	10 U	20 U
subsurface	Aroclor 1248 (ug/kg)		40	0	0						10 U	20 UJ	11.7	10 U	20 U
subsurface	Aroclor 1254 (ug/kg)		40	22	55	10	1800	329	84	1200	10 U	1800	186	22	1200
subsurface	Aroclor 1260 (ug/kg)		40	18	45	18	810	165	77	490	10 U	810	80.9	20 U	440
subsurface	Aroclor 1221 (ug/kg)		40	0	0						10 U	40 U	15.1	10 U	40 U
subsurface	Aroclor 1232 (ug/kg)		40	1	2.5	10	10	10	10	10	10 U	20 UJ	11.7	10 U	20 U
subsurface	Polychlorinated biphenyls (ug/kg)		40	22	55	10 A	2379 A	467	150 A	1640 A	10 UA	2379 A	263	40 UA	1640 A
subsurface	Butyltin ion (ug/kg)		4	4	100	8.4	260	117	60	140	8.4	260	117	60	140
subsurface	Dibutyltin ion (ug/kg)		4	3	75	130 J	1300 J	550	220 J	220 J	5.7 U	1300 J	414	130 J	220 J
subsurface	Tributyltin ion (ug/kg)		21	16	76.2	1	90000	9550	570	17000	1 U	90000	7280	28	15000
subsurface	Tetrabutyltin (ug/kg)		4	3	75	16	100	53.3	44	44	5.7 U	100	41.4	16	44
subsurface	Total solids (percent)		56	56	100	44.3	87	65.1	67.7	84.3	44.3	87	65.1	67.7	84.3
subsurface	Total organic carbon (percent)		56	53	94.6	0.06	3.12	1.23	0.89	2.66	0.05 U	3.12	1.17	0.85	2.66
subsurface	Gravel (percent)		36	36	100	0.01	15.9	1.85	0.11	9.17	0.01	15.9	1.85	0.11	9.17
subsurface	Sand (percent)		67	67	100	3.4	98.32	42.1	33.42	94.41	3.4	98.32	42.1	33.42	94.41
subsurface	Fines (percent)		67	67	100	1.11	97.24	56.3	58.7	90.34	1.11	97.24	56.3	58.7	90.34
subsurface	Silt (percent)		67	67	100	0.83	86.3	45.9	48.11	76.62	0.83	86.3	45.9	48.11	76.62
subsurface	Clay (percent)		67	67	100	0.31	24.38	10.4	9.95	20.31	0.31	24.38	10.4	9.95	20.31
subsurface	Aluminum (mg/kg)		4	4	100	40600	44200	42700	42100	43900	40600	44200	42700	42100	43900
subsurface	Antimony (mg/kg)		54	14	25.9	0.1 G	4.4	1.11	0.2 X	4	0.1 UG	9 UJ	0.528	0.1 UG	3.5
subsurface	Arsenic (mg/kg)		60	51	85	2	140	9.93	4	21	2 U	140	8.84	3	21
subsurface	Cadmium (mg/kg)		60	32	53.3	0.1	1.98 E	0.6	0.4	1.38 E	0.1	1.98 E	0.367	0.2	1.29 E
subsurface	Chromium (mg/kg)		60	60	100	7	95 G	28.5	25	54 G	7	95 G	28.5	25	54 G
subsurface	Copper (mg/kg)		60	60	100	10.5	2200	215	32.1	1500	10.5	2200	215	32.1	1500
subsurface	Lead (mg/kg)		60	59	98.3	2.1	330 G	37.9	13.7 E	140 G	2.1	330 G	37.5	13.1	140 G
subsurface	Manganese (mg/kg)		7	7	100	419	872	675	814	836	419	872	675	814	836
subsurface	Mercury (mg/kg)		60	41	68.3	0.02	2.1	0.28	0.12	0.73	0.02	2.1	0.207	0.07	0.73
subsurface	Nickel (mg/kg)		60	60	100	13	43 J	24.7	24	37.1	13	43 J	24.7	24	37.1

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
subsurface	Selenium (mg/kg)		4	4	100	9	14	11.8	11	13	9	14	11.8	11	13
subsurface	Silver (mg/kg)		60	29	48.3	0.1	1.6	0.551	0.4	1.5	0.1 U	1.6	0.363	0.1 U	1.3
subsurface	Thallium (mg/kg)		4	1	25	9	9	9	9	9	5 U	10 U	8.25	9	9 U
subsurface	Zinc (mg/kg)		60	60	100	24	1500 L	228	69.2	1340	24	1500 L	228	69.2	1340
subsurface	Barium (mg/kg)		4	4	100	200	281	227	203	224	200	281	227	203	224
subsurface	Beryllium (mg/kg)		4	4	100	0.6	0.7	0.675	0.7	0.7	0.6	0.7	0.675	0.7	0.7
subsurface	Calcium (mg/kg)		4	4	100	8440	16000	11900	8850	14200	8440	16000	11900	8850	14200
subsurface	Cobalt (mg/kg)		4	4	100	19.6	20.8	20.2	19.7	20.6	19.6	20.8	20.2	19.7	20.6
subsurface	Iron (mg/kg)		7	7	100	34700	53300	44300	45700	49300	34700	53300	44300	45700	49300
subsurface	Magnesium (mg/kg)		4	4	100	7400	8510	7750	7460	7630	7400	8510	7750	7460	7630
subsurface	Potassium (mg/kg)		4	4	100	1410	1550	1480	1430	1510	1410	1550	1480	1430	1510
subsurface	Sodium (mg/kg)		4	4	100	976	1160 J	1070	1050	1100	976	1160 J	1070	1050	1100
subsurface	Tin (mg/kg)		3	3	100	2.28 G	4.46 G	3.72	4.42 G	4.42 G	2.28 G	4.46 G	3.72	4.42 G	4.42 G
subsurface	Titanium (mg/kg)		7	7	100	1930	3490	2290	1960	2590	1930	3490	2290	1960	2590
subsurface	Vanadium (mg/kg)		4	4	100	103	109	106	106	107	103	109	106	106	107
subsurface	2-Methylnaphthalene (ug/kg)		39	19	48.7	10	220 G	55.3	23	210	10	220 G	32.3	10 U	170 G
subsurface	Acenaphthene (ug/kg)		42	19	45.2	13	430 G	116	40	380	6.7 U	430 G	57.9	10 U	320
subsurface	Acenaphthylene (ug/kg)		42	7	16.7	11	32	16.1	14	16	6.7 U	50 UG	15	10 U	33.5 U
subsurface	Anthracene (ug/kg)		42	24	57.1	11	870 G	151	53.3	530	6.7 U	870 G	96.2	23	320
subsurface	Fluorene (ug/kg)		42	21	50	10	800 G	152	48	430	6.7 U	800 G	81.5	14	340
subsurface	Naphthalene (ug/kg)		42	22	52.4	11	260 G	56.9	35	110	6.7 U	260 G	34.4	11	58.7
subsurface	Phenanthrene (ug/kg)		42	27	64.3	29 G	3700 G	628	246	2300	6.7 U	3700 G	407	77	2200
subsurface	Low Molecular Weight PAH (ug/kg)		42	27	64.3	29 A	5780 A	1010	378 A	3860 A	6.7 UA	5780 A	655	148 A	3322 A
subsurface	Dibenz(a,h)anthracene (ug/kg)		42	16	38.1	14	290	68.2	27	162 G	6.7 U	290	33.4	10 UG	110
subsurface	Benz(a)anthracene (ug/kg)		42	27	64.3	22 G	1300	298	148	1200 G	6.7 U	1300	195	50	880
subsurface	Benzo(a)pyrene (ug/kg)		42	27	64.3	22 G	1300 G	276	158	1000 G	6.7 U	1300 G	181	57	770
subsurface	Benzo(b)fluoranthene (ug/kg)		42	27	64.3	22 G	1400	316	174	1300 G	6.7 U	1400	207	47	1000
subsurface	Benzo(g,h,i)perylene (ug/kg)		42	27	64.3	13	740	170	79	610 G	6.7 U	740	113	46	430
subsurface	Benzo(k)fluoranthene (ug/kg)		42	27	64.3	19 G	1000 G	198	110	570 G	6.7 U	1000 G	131	41	440
subsurface	Chrysene (ug/kg)		42	27	64.3	28 G	1400 G	338	180	1300 G	6.7 U	1400 G	221	68	1000
subsurface	Fluoranthene (ug/kg)		42	27	64.3	38	3300 G	728	308	2700 G	6.7 U	3300 G	471	123	2200
subsurface	Indeno(1,2,3-cd)pyrene (ug/kg)		42	27	64.3	17	970	199	96	670 G	6.7 U	970	132	41	450
subsurface	Pyrene (ug/kg)		42	28	66.7	13	2800 G	629	320	2400 G	6.7 U	2800 G	422	150	1800
subsurface	Benzo(b+k)fluoranthene (ug/kg)		42	27	64.3	41 A	2300 A	525	298 A	1870 A	6.7 UA	2300 A	341	86 A	1440 A
subsurface	High Molecular Weight PAH (ug/kg)		42	28	66.7	13 A	13420 A	3090	1688 A	12400 A	6.7 UA	13420 A	2060	644 A	9080 A
subsurface	Polycyclic Aromatic Hydrocarbons (ug/kg		42	28	66.7	13 A	19200 A	4070	2018.8 A	16202 A	6.7 UA	19200 A	2720	867 A	12940 A
subsurface	4,4'-DDD (ug/kg)		1	0	0						1.9 UJ	1.9 UJ	1.9	1.9 UJ	1.9 UJ
subsurface	4,4'-DDE (ug/kg)		1	0	0						1.9 UJ	1.9 UJ	1.9	1.9 UJ	1.9 UJ
subsurface	4,4'-DDT (ug/kg)		1	0	0						2.7 UIJ	2.7 UIJ	2.7	2.7 UIJ	2.7 UIJ
subsurface	Total of 3 isomers: pp-DDT,-DDD,-DDE (ug/kg)		1	0	0						2.7 UA	2.7 UA	2.7	2.7 UA	2.7 UA
subsurface	Aldrin (ug/kg)		1	0	0						0.96 UJ	0.96 UJ	0.96	0.96 UJ	0.96 UJ
subsurface	alpha-Hexachlorocyclohexane (ug/kg)		1	0	0						0.96 UJ	0.96 UJ	0.96	0.96 UJ	0.96 UJ
subsurface	beta-Hexachlorocyclohexane (ug/kg)		1	0	0						0.96 UJ	0.96 UJ	0.96	0.96 UJ	0.96 UJ
subsurface	delta-Hexachlorocyclohexane (ug/kg)		1	0	0						0.96 UJ	0.96 UJ	0.96	0.96 UJ	0.96 UJ
subsurface	gamma-Hexachlorocyclohexane (ug/kg)		1	0	0						0.96 UJ	0.96 UJ	0.96	0.96 UJ	0.96 UJ
subsurface	cis-Chlordane (ug/kg)		1	0	0						0.96 UJ	0.96 UJ	0.96	0.96 UJ	0.96 UJ
subsurface	Dieldrin (ug/kg)		1	0	0						1.9 UJ	1.9 UJ	1.9	1.9 UJ	1.9 UJ
subsurface	alpha-Endosulfan (ug/kg)		1	0	0						0.96 UJ	0.96 UJ	0.96	0.96 UJ	0.96 UJ
subsurface	beta-Endosulfan (ug/kg)		1	0	0						1.9 UJ	1.9 UJ	1.9	1.9 UJ	1.9 UJ
subsurface	Endosulfan sulfate (ug/kg)		1	0	0						1.9 UJ	1.9 UJ	1.9	1.9 UJ	1.9 UJ
subsurface	Endrin (ug/kg)		1	0	0						1.9 UJ	1.9 UJ	1.9	1.9 UJ	1.9 UJ
subsurface	Endrin aldehyde (ug/kg)		1	0	0						3.7 UIJ	3.7 UIJ	3.7	3.7 UIJ	3.7 UIJ
subsurface	Endrin ketone (ug/kg)		1	0	0						7.3 UIJ	7.3 UIJ	7.3	7.3 UIJ	7.3 UIJ
subsurface	Heptachlor (ug/kg)		1	0	0						0.96 UJ	0.96 UJ	0.96	0.96 UJ	0.96 UJ
subsurface	Heptachlor epoxide (ug/kg)		1	0	0						0.96 UJ	0.96 UJ	0.96	0.96 UJ	0.96 UJ
subsurface	Methoxychlor (ug/kg)		1	0	0						9.6 UJ	9.6 UJ	9.6	9.6 UJ	9.6 UJ
subsurface	Toxaphene (ug/kg)		1	0	0						96 UJ	96 UJ	96	96 UJ	96 UJ
subsurface	gamma-Chlordane (ug/kg)		1	0	0						1.3 UIJ	1.3 UIJ	1.3	1.3 UIJ	1.3 UIJ
subsurface	2,4,5-Trichlorophenol (ug/kg)		40	0	0						40 U	250 UG	61.5	40 U	250 U
subsurface	2,4,6-Trichlorophenol (ug/kg)		40	0	0						30 U	99 U	38.2	30 U	96 U
subsurface	2,4-Dichlorophenol (ug/kg)		40	0	0						50 U	100 U	92.1	100 U	100 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
subsurface	2,4-Dimethylphenol (ug/kg)		40	0	0						19 U	50 UG	22.2	20 U	50 U
subsurface	2,4-Dinitrophenol (ug/kg)		40	0	0						190 UJ	300 U	286	300 U	300 U
subsurface	2-Chlorophenol (ug/kg)		40	0	0						19 U	50 U	46.9	50 U	50 U
subsurface	2-Methylphenol (ug/kg)		40	0	0						19 U	100 U	88.2	100 U	100 U
subsurface	2-Nitrophenol (ug/kg)		40	0	0						40 U	99 U	46.5	40 U	96 U
subsurface	4,6-Dinitro-2-methylphenol (ug/kg)		40	0	0						100 U	250 UG	121	100 U	250 U
subsurface	4-Chloro-3-methylphenol (ug/kg)		40	0	0						38 U	50 U	48.9	50 U	50 U
subsurface	4-Methylphenol (ug/kg)		40	7	17.5	50	114	88.1	90	97 J	50 U	114	96.7	100 U	100 UG
subsurface	4-Nitrophenol (ug/kg)		40	0	0						96 U	250 UG	111	100 U	250 U
subsurface	Pentachlorophenol (ug/kg)		40	0	0						96 U	250 UG	111	100 U	250 U
subsurface	Phenol (ug/kg)		40	2	5	22	27	24.5	22	22	19 U	50 U	47.2	50 U	50 U
subsurface	Dimethyl phthalate (ug/kg)		43	5	11.6	10	99 G	37.8	11	59 N	10 U	99 G	16	10	50 U
subsurface	Diethyl phthalate (ug/kg)		43	3	6.98	15 J	16.3 J	15.8	16 J	16 J	10 U	50 UG	14.1	10 U	20 U
subsurface	Dibutyl phthalate (ug/kg)		43	20	46.5	10	198 G	48.7	26.6	135	10 U	250 UG	39.4	11	135
subsurface	Butylbenzyl phthalate (ug/kg)		43	19	44.2	12	260	58.4	24	215	10 U	260	35.1	10 U	130 U
subsurface	Di-n-octyl phthalate (ug/kg)		43	6	14	18	3180	713	45.4	851	10 U	3180	112	10 U	50 UG
subsurface	Bis(2-ethylhexyl) phthalate (ug/kg)		43	40	93	10 B	16000 G	916	296	1900 G	10 U	16000 G	853	290	1780
subsurface	Bis(2-chloro-1-methylethyl) ether (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	2,4-Dinitrotoluene (ug/kg)		7	0	0						50 U	99 U	76.9	96 U	97 U
subsurface	2,6-Dinitrotoluene (ug/kg)		7	0	0						50 U	99 U	76.9	96 U	97 U
subsurface	2-Chloronaphthalene (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	2-Nitroaniline (ug/kg)		7	0	0						96 U	250 UG	163	99 U	250 U
subsurface	3,3'-Dichlorobenzidine (ug/kg)		7	0	0						96 U	250 UG	163	99 U	250 U
subsurface	3-Nitroaniline (ug/kg)		7	0	0						110 U	250 UG	174	120 UJ	250 U
subsurface	4-Bromophenyl phenyl ether (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	4-Chloroaniline (ug/kg)		7	0	0						50 U	60 U	54.7	57 U	58 U
subsurface	4-Chlorophenyl phenyl ether (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	4-Nitroaniline (ug/kg)		7	0	0						96 U	250 UG	163	99 U	250 U
subsurface	Aniline (ug/kg)		3	0	0						50 U	50 UG	50	50 U	50 U
subsurface	Benzoic acid (ug/kg)		7	1	14.3	560	560	560	560	560	190 U	560	270	250 U	250 UG
subsurface	Benzyl alcohol (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	Bis(2-chloroethoxy) methane (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	Bis(2-chloroethyl) ether (ug/kg)		7	0	0						38 U	50 UG	43.6	40 U	50 U
subsurface	Carbazole (ug/kg)		7	6	85.7	19 J	260 G	120	71	230	19 J	260 G	106	71	230
subsurface	Dibenzofuran (ug/kg)		40	16	40	11	360 G	90	27	270	10 U	360 G	42.2	10 U	266 G
subsurface	Hexachlorobenzene (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	Hexachlorobutadiene (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	Hexachlorocyclopentadiene (ug/kg)		7	0	0						50 U	99 U	76.9	96 U	97 U
subsurface	Hexachloroethane (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	Isophorone (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	Nitrobenzene (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	N-Nitrosodipropylamine (ug/kg)		7	0	0						38 U	50 UG	43.6	40 U	50 U
subsurface	N-Nitrosodiphenylamine (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	Benzidine (ug/kg)		3	0	0						250 U	250 UG	250	250 U	250 U
subsurface	1,2-Dichlorobenzene (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	1,3-Dichlorobenzene (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	1,4-Dichlorobenzene (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U
subsurface	1,2,4-Trichlorobenzene (ug/kg)		7	0	0						19 U	50 UG	32.4	20 U	50 U

SUPPLEMENTAL FIGURES

Site map, Portland Shipyard (Bridgewater Group)
Soil and Groundwater Sampling Locations (Bridgewater Group)
Groundwater Monitoring Well Locations (Bridgewater Group, 2003)
Figure 16, Substation Location Map (Bridgewater Group)
Storm Water Basin Maps, Basin J,K (Port of Portland, 2002)

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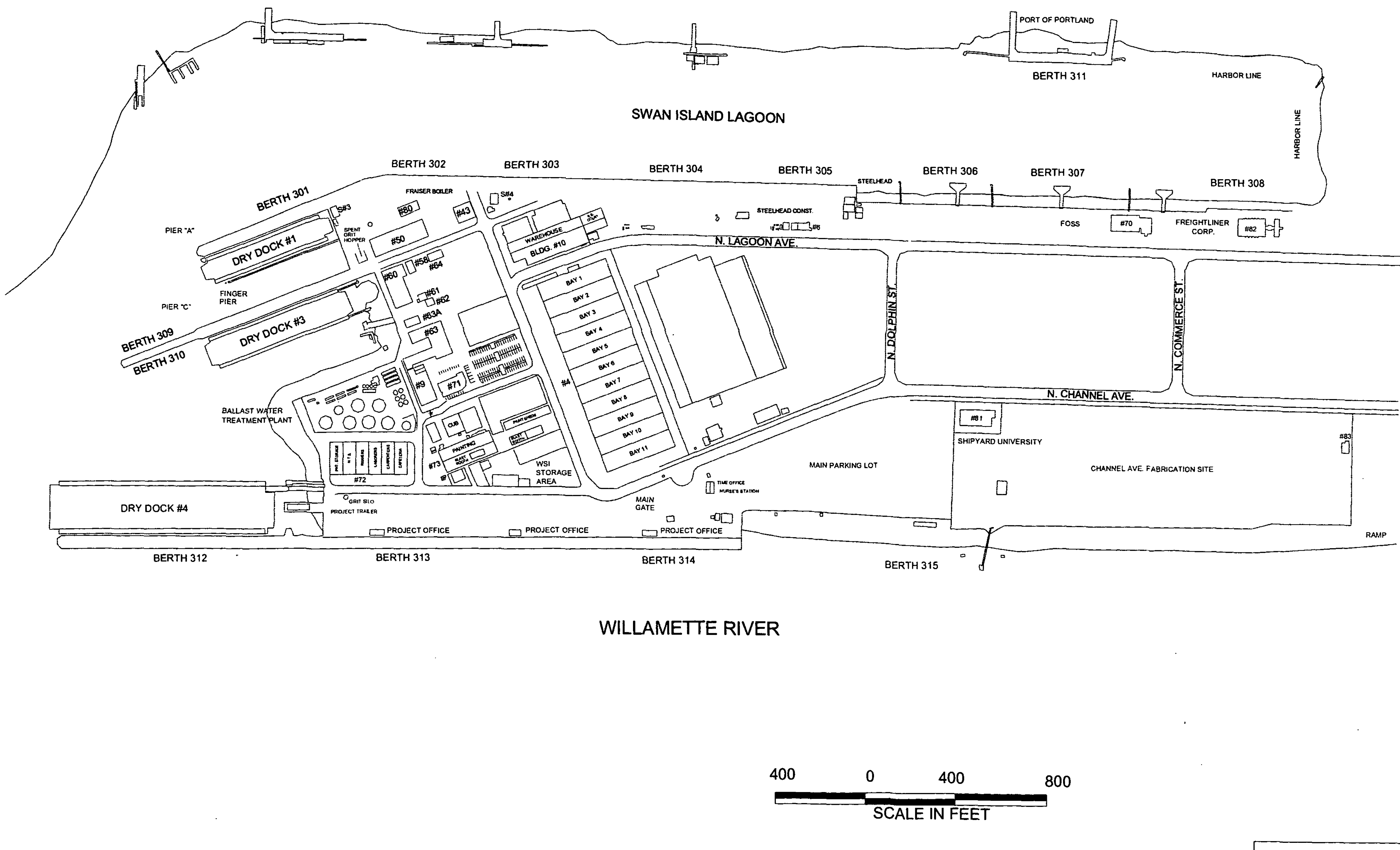
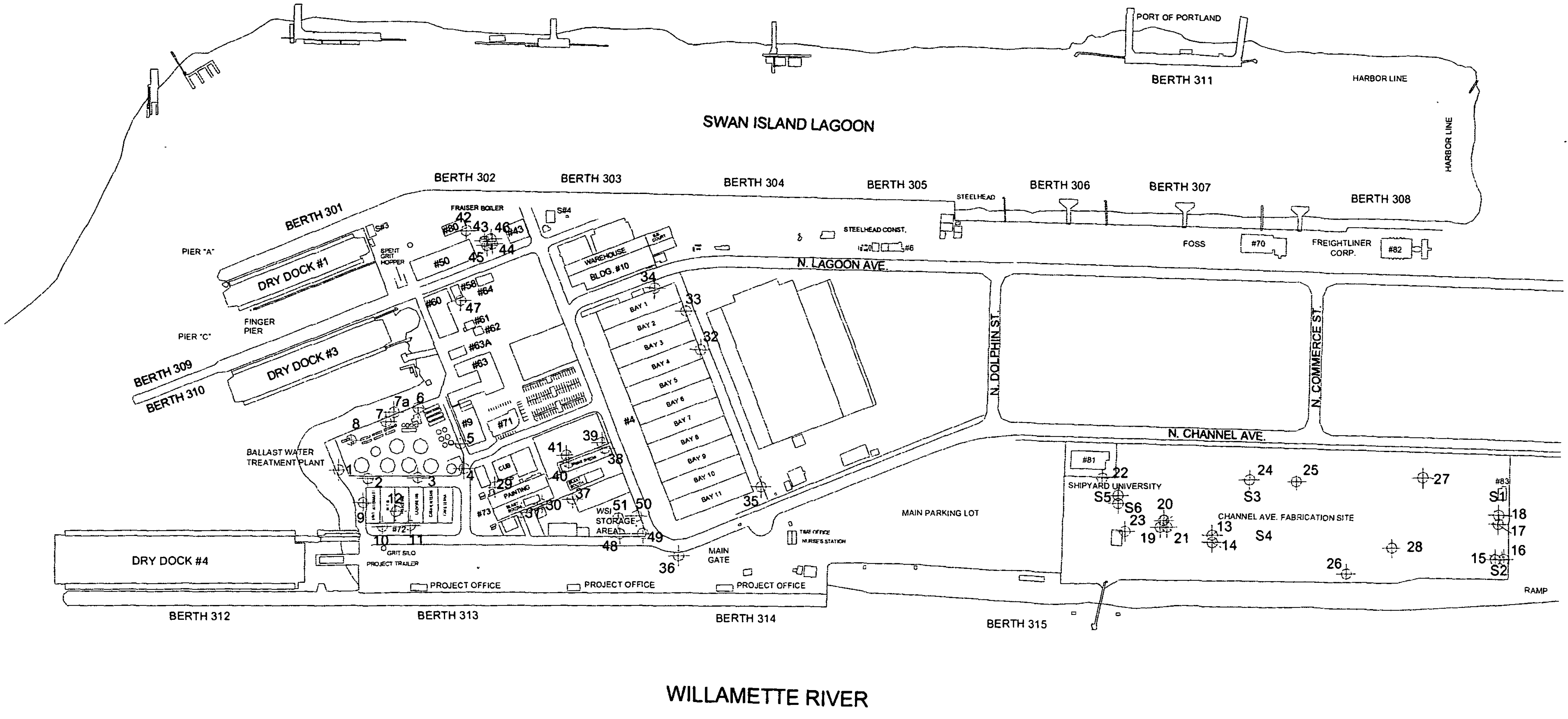


Site Map
Portland Shipyard

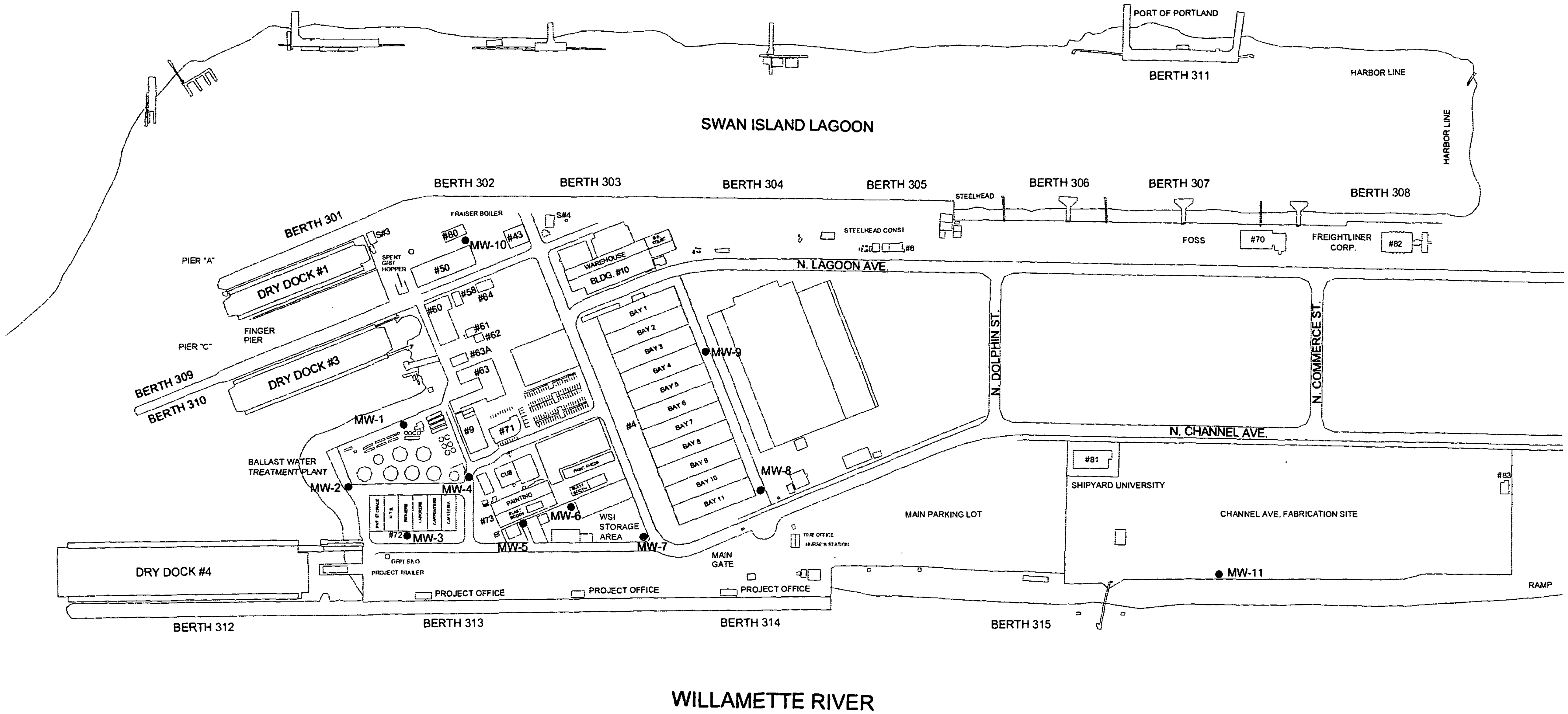
BRIDGEWATER GROUP, INC.



Legend:
Phase IA Sampling Locations

0 ft. 250 ft. 500 ft. 1000 ft.

Soil and Groundwater Sampling Locations
Portland Shipyard Remedial Investigation
BRIDGEWATER GROUP, INC.



Legend:
● Phase IB Groundwater Monitoring Well Locations

0 ft. 250 ft. 500 ft. 1000 ft.

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Figure 3
Groundwater Monitoring Well Locations
PSY RI/FS, 2003 Annual Groundwater Sampling Results

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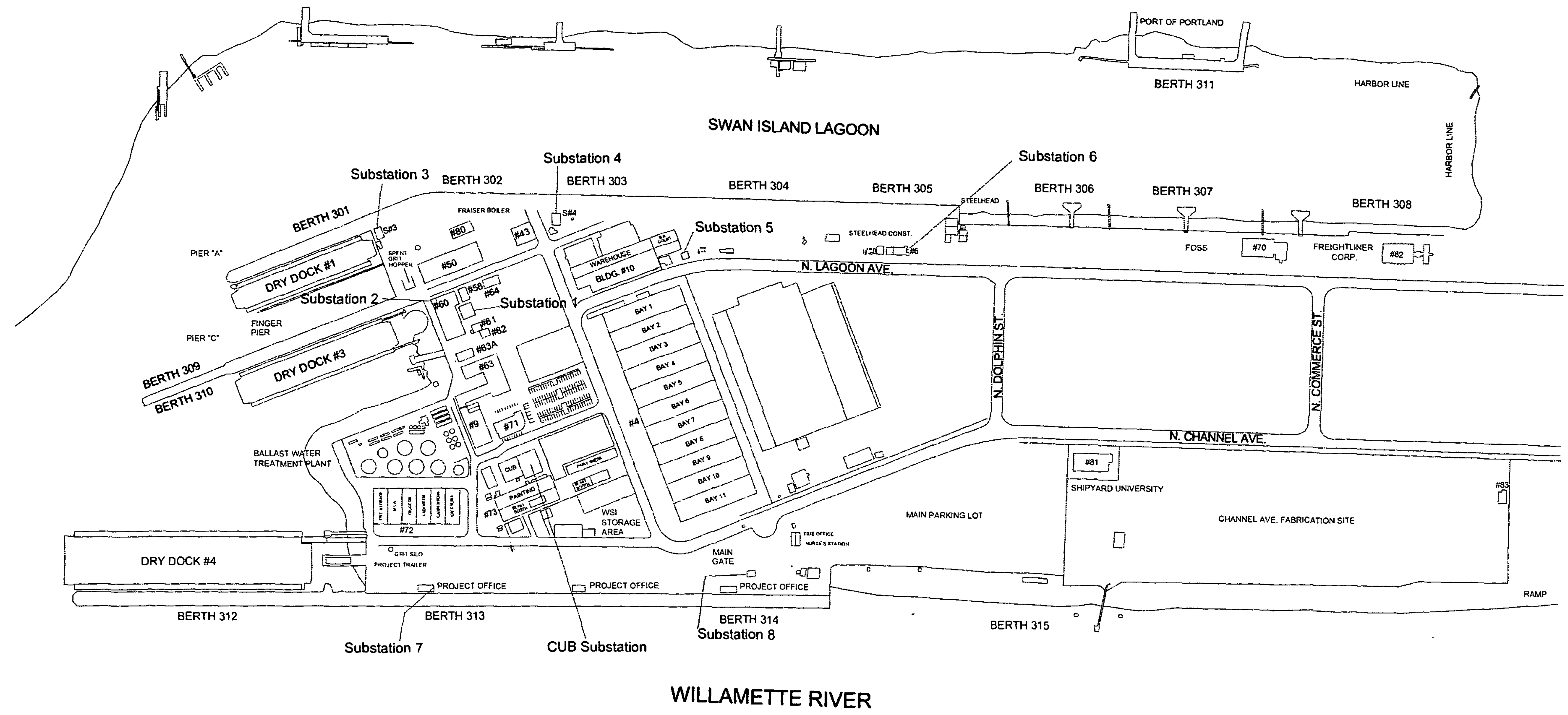
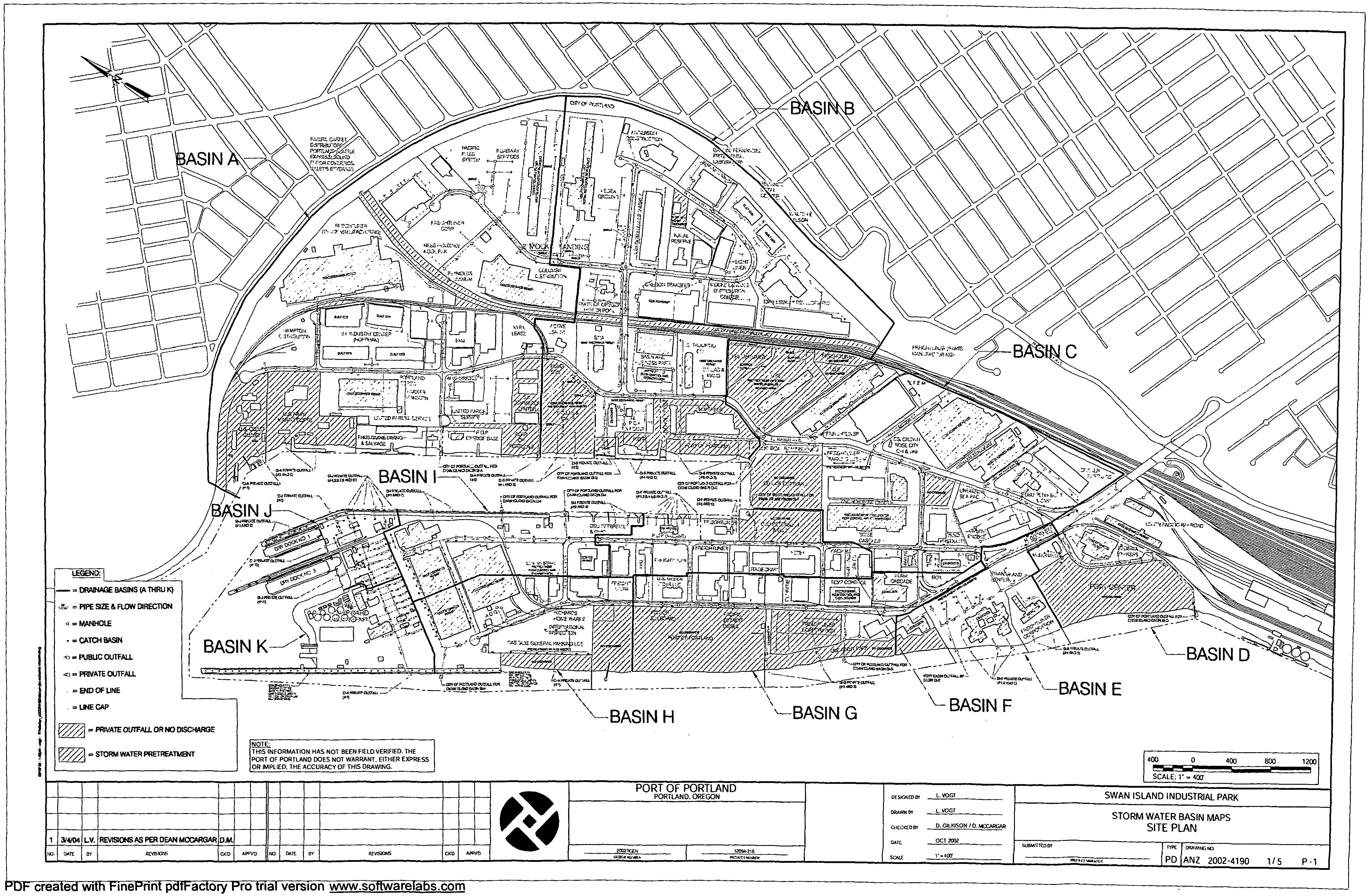


Figure 16 (Revised)
Substation Location Map
PSY RI/FS Work Plan
BRIDGEWATER GROUP, INC.



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SUPPLEMENTAL TABLES

Tables 2, 3 and 4. 2003 Annual Groundwater Sampling Results

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Table 2
2003 Annual Groundwater Sampling Results
Total Metal Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Antimony, Total	Arsenic, Total	Cadmium, Total	Chromium, Total[d]	Copper, Total	Lead, Total	Mercury, Total	Nickel, Total	Silver, Total	Zinc, Total
Human Health Consumption AWQC[a]					*640*	*0.14*	*NC*	*NC*	*NC*	*NC*	*0.3*	*4,600*	*NC*	*26,000*
Freshwater WQC[b]					*NC*	*150*	*0.25*	*74*	*9*	*2.5*	*0.77*	*52*	*NC*	*120*
SLV[c]					*1,600*	*150*	*2.2*	*74*	*9*	*2.5*	*0.77*	*52*	*0.12*	*120*
BWTP and Building 72 Area	MW-1	12/18/01	4800-011218-253		0.2 U	9.9	0.68	117	240	46.7	0.2 U	88.6	0.27	233
		3/26/02	4800-020326-265		0.1 U	5.1	0.32	44.5	90.7	16.4	0.55	38.9	0.22	106
		7/1/02	4800-020701-281		0.1 U	13.4	0.1 U	10.0	24.2	5.96	0.2 U	37.4	0.07	21.2
		10/8/02	4800-021008-296		0.1 U	5.8	0.35	37.1	74.5	15.7	0.2 U	39.3	0.13	76.8
		12/2/03	4800-031202-412		0.1 U	9.8	0.14	1.1	1.7 N	0.14	0.2 U	17.6	0.04 U	1.1
		12/2/03	4800-031202-412	X	0.1 U	10.5	0.17	0.7	2.2 N	0.11	0.2 U	19.1	0.04 U	1.2
	MW-2	12/18/01	4800-011218-256		0.2 U	6.3	0.32	28.5	44.3	11.1	0.2 U	44.6	0.1	68.1
		12/18/01	4800-011218-256	X	0.1 U	3.2	0.17	16.2	25.9	6.82	0.2 U	23.3	0.05	36.7
		3/26/02	4800-020326-266		0.05 U	3.4	0.05 U	2.1	2.6	0.79	0.2 U	18.8	0.04	3.3
		7/1/02	4800-020701-282		0.05 U	11.8	0.05 U	1.3	1.3	0.16	0.2 U	15.5	0.02 U	5.2
		7/1/02	4800-020701-282-DUP	X	0.05 U	12.3	0.05 U	1.3	0.4	0.15	0.2 U	14.6	0.02 U	0.9
		10/8/02	4800-021008-297		0.1 U	2.8	0.1 U	4.6	8.3	3.46	0.2 U	23.3	0.04 U	10.4
	MW-3	12/18/01	4800-011218-255		0.1 U	3.0	0.19	6.3	8.6	1.81	0.2 U	11.3	0.03	13.6
		3/27/02	4800-020327-267		0.25 U	16.4	0.49	74.3	109	27.1	0.23	88.4	0.35	217
		7/2/02	4800-020702-283		0.1 U	6.2	0.12	7.7	15.0	3.78	0.2 U	9.6	0.04 U	21.2
		10/8/02	4800-021008-298		0.1 U	7.1	0.14	9.2	15.7	3.83	0.2 U	11.8	0.04	22.7
		3/26/03	4800-030326-402		0.05 U	2.5	0.05 U	6.2	0.5	0.09	0.2 U	5.2	0.02 U	28.0
		12/2/03	4800-031202-411		0.1	9.7	0.21	1.6	2.08 N	0.36	0.2 U	8.5	0.04 U	2.0
	MW-4	12/18/01	4800-011218-254		0.1 U	5.3	0.05 U	3.7	3.3	0.81	0.2 U	6.4	0.02 U	6.2
		3/27/02	4800-020327-268		0.05 U	2.2	0.05 U	0.5	0.3	0.1	0.2 U	5.8	0.02 U	0.8
		7/2/02	4800-020702-284		0.05 U	2.4	0.05 U	0.5	0.4	0.04	0.2 U	5.4	0.02 U	1.0
		10/8/02	4800-021008-299		0.05 U	2.2	0.05 U	0.3	0.5	0.1	0.2 U	5.3	0.02 U	0.9
		3/26/03	4800-030326-403-upper		0.05 U	0.5 U	0.05 U	0.8	0.5	0.02 U	0.2 U	5.3	0.02 U	17.6
		3/26/03	4800-030326-404-upper	X	0.05 U	0.5 U	0.05 U	0.7	0.5	0.02 U	0.2 U	5.1	0.02 U	16.3
		3/26/03	4800-030326-405-lower		0.05 U	2.1	0.05 U	1.1	0.4	0.05	0.2 U	5.7	0.02 U	1.9
Paint Shed/Blast Booth, Building 73 Area	MW-5	12/18/01	4800-011218-257		0.1 U	0.5 U	0.18	2.7	2.6	0.24	0.2 U	5.4	0.02 U	8.0
		3/27/02	4800-020327-269		0.05 U	2.3	0.05 U	3.4	3.4	0.84	0.2 U	5.2	0.05	5.9
		7/2/02	4800-020702-285		0.05 U	1.1	0.05 U	2.1	1.8	0.32	0.2 U	4.4	0.02 U	2.4
		10/8/02	4800-021008-300		0.11	4.2	0.1 U	6.3	8.3	2.07	0.2 U	8.5	0.04 U	14.3
	MW-6	12/18/01	4800-011218-258		0.2 U	2.5	0.17	14.2	17.9	3.27	0.2 U	18.5	0.04 U	30.1
		3/27/02	4800-020327-270		0.33	6.4	0.25	26.0	27.8	7.07	0.2 U	86.9	0.36	55.7
		7/2/02	4800-020702-286		0.1 U	2.0	0.1 U	12.9	14.9	4.41	0.2 U	22.2	0.04 U	28.2
		10/8/02	4800-021008-301		0.1 U	2.2	0.1 U	12.9	14.5	4.25	0.2 U	18.2	0.04 U	28.9
		12/3/03	4800-031203-414		0.1 U	1 U	0.13	0.7	1.42 N	0.05	0.2 U	5.1	0.04 U	1.4
	MW-7	12/18/01	4800-011218-259		0.2 U	2.4	0.2	8.4	9.2	1.63	0.2 U	14.8	0.04 U	15.6
		3/28/02	4800-020328-272		0.25 U	17.2	0.25 U	46.9	60.1	14.6	0.2 U	55.1	0.21	119
		3/28/02	4800-020328-273	X	0.25 U	14.6	0.25 U	26.4	32.8	7.48	0.2 U	35.1	0.16	67.4
		7/2/02	4800-020702-287		0.1 U	6.6	0.1 U	8.4	11.5	2.99	0.2 U	12.1	0.04 U	18.7
		10/9/02	4800-021009-303		0.1 U	6.0	0.1 U	6.0	8.6	1.67	0.2 U	10.7	0.04 U	12.2
		3/27/03	4800-030327-406		0.05 U	6.7	0.05 U	1.4	0.3	0.02 U	0.2 U	3.1	0.02 U	0.6
		12/4/03	4800-031204-417		0.1 U	4.5	0.2	0.6	2.1 N	0.08	0.2 U	12.2	0.04 U	1.5

Table 2
2003 Annual Groundwater Sampling Results
Total Metal Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Antimony, Total	Arsenic, Total	Cadmium, Total	Chromium, Total[d]	Copper, Total	Lead, Total	Mercury, Total	Nickel, Total	Silver, Total	Zinc, Total
Human Health Consumption AWQC[a]					*640*	*0.14*	*NC*	*NC*	*NC*	*NC*	*0.3*	*4,600*	*NC*	*26,000*
Freshwater WQC[b]					*NC*	*150*	*0.25*	*74*	*9*	*2.5*	*0.77*	*52*	*NC*	*120*
SLV[c]					*1,600*	*150*	*2.2*	*74*	*9*	*2.5*	*0.77*	*52*	*0.12*	*120*
Building 4 Area	MW-8	12/19/01	4800-011219-263		0.1 U	29.6	0.05 U	4.4	2.0	0.48	0.2 U	3.9	0.02 U	3.5
		3/28/02	4800-020328-274		0.05 U	23.1	0.07	0.8	0.2	0.05	0.2 U	3.7	0.02 U	0.9
		7/3/02	4800-0207-03-290		0.05 U	15.5	0.05 U	0.4	0.4	0.16	0.2 U	3.4	0.02 U	1.0
		10/9/02	4800-021009-304		0.05 U	14.9	0.05 U	0.5	0.4	0.08	0.2 U	3.3	0.02 U	0.7
		10/9/02	4800-021009-305	X	0.05 U	15.2	0.05 U	0.4	0.5	0.09	0.2 U	3.4	0.02 U	0.8
		3/27/03	4800-030327-407-upper		0.05 U	6.3	0.05 U	2.4	0.5	0.07	0.2 U	7.9	0.02 U	0.8
		3/27/03	4800-030327-408-lower		0.05 U	10.2	0.05 U	0.8	0.3	0.02 U	0.2 U	5.9	0.02 U	0.6
	MW-9	12/19/01	4800-011219-262		0.2 U	22.3	0.17	10.1	11.4	2.22	0.2 U	10.7	0.04	15.6
		3/28/02	4800-020328-275		0.05 U	20.6	0.05 U	2.7	0.9	0.18	0.2 U	7.4	0.02 U	2.6
		7/3/02	4800-0207-03-291		0.05 U	22.3	0.05 U	4.9	1.9	0.4	0.2 U	10.1	0.02 U	2.1
		10/9/02	4800-021009-306		0.05 U	18.4	0.05 U	1.0	1.4	0.35	0.2 U	4.1	0.02 U	1.9
Building 43, 50 and 80 Area	MW-10	12/19/01	4800-011219-261		0.2 U	21.7	0.18	13.0	15.6	4.51	0.2 U	12.3	0.06	25.1
		3/28/02	4800-020328-276		0.05 U	9.4	0.05 U	2.2	1.2	0.31	0.2 U	5.5	0.02 U	2.4
		7/3/02	4800-0207-03-292		0.05 U	9.7	0.05 U	0.6	0.7	0.1	0.2 U	2.8	0.02 U	1.1
		10/9/02	4800-021009-307		0.05 U	16.6	0.05 U	0.4	0.4	0.06	0.2 U	1.6	0.02 U	1.0
N. Channel Avenue Fabrication Site	MW-11	12/18/01	4800-011218-252		0.1 U	0.9	0.07	3.5	1.5	0.32	0.2 U	5.6	0.02 U	3.4
		4/10/02	4800-020410-278		0.25 U	2.1	0.25 U	23.5	35.8	18.5	0.2 U	29.4	0.14	266
		7/3/02	4800-0207-03-293		0.05 U	0.8	0.05 U	2.9	1.8	0.45	0.2 U	7.8	0.02 U	8.7
		10/9/02	4800-021009-308		0.1 U	16.7	0.16	20.7	54.5	11.6	0.2 U	22.3	0.04	145
		12/4/03	4800-031204-418		0.1 U	2.2	0.07	0.4 U	0.46 N	0.04 U	0.2 U	2.2	0.04 U	1
	EB	12/19/2002	4800-011219-260		0.1 U	0.5 U	0.05 U	1.6	0.7	0.06	0.2 U	0.6	0.02 U	1.4
	EB	3/28/2002	4800-020328-271		0.05 U	0.5 U	0.05 U	0.3	0.1	0.02	0.2 U	0.2 U	0.02 U	0.5
	EB	7/3/02	4800-0207-03-289		0.05 U	0.5 U	0.05 U	0.8	0.4	0.04	0.2 U	0.7	0.02 U	1.0
	EB	10/9/02	4800-021009-302		0.05 U	0.5 U	0.05 U	0.7	0.5	0.02 U	0.2 U	0.5	0.02 U	1.1
	EB	3/27/03	4800-030327-409		0.05 U	0.5 U	0.05 U	0.5	0.7	0.02	0.2 U	0.3	0.02 U	0.8
	EB	12/3/03	4800-031203-416		0.1 U	1 U	0.04 U	0.4 U	0.7 N	0.04 U	0.2 U	0.4 U	0.04 U	1 U

U = not detected
N = matrix spike was outside control criteria
EB = equipment blank
[a]EPA National Recommended Water Quality Criteria: 2002, Protection of Human Health from Organism Consumption Only, November 2002.
[b]EPA National Recommended Water Quality Criteria: 2002, Protection of Freshwater Aquatic Organisms, Criterion Continuous Concentration (CCC), November 2002.
[c]DEQ Level II Screening Level Values (SLVs), December 2001.
[d]AWQC and SLV for Chromium III..
NA = not analyzed
NC = no criteria or screening level
Shading indicates sampling result exceeds protection of human health AWQC.
Box indicates result exceeds protection of freshwater aquatic organisms AWQC or SLV.

Table 3
2003 Annual Groundwater Sampling Results
Volatile Organic Compound (VOC) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Dichlorodifluoromethane (CFC 12)	Chloromethane	Vinyl Chloride	Bromomethane	Chloroethane	Trichlorofluoromethane (CFC 11)	Acetone	1,1-Dichloroethene (1,1-DCE)	Carbon Disulfide	Dichloromethane (Methylene Chloride)	trans-1,2-Dichloroethene	1,1-Dichloroethane (1,1-DCA)
Human Health Consumption AWQC[a]					*NC*	*NC*	*530*	*NC*	*NC*	*NC*	*NC*	*3.2*	*NC*	*590*	*140,000*	*NC*
Risk-Based Concentration[b]					*NC*	*NC*	*840*	*NC*	*NC*	*NC*	*NC*	*330,000*	*NC*	*NC*	*390,000*	*NC*
Freshwater WQC[c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV[d]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*1,500*	*25*	*0.92*	*2,200*	*590*	*47*
BWTP and Building 72 Area	MW-1	12/18/01	4800-011218-253		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		3/26/02	4800-020326-265		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		7/1/02	4800-020701-281		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		10/8/02	4800-021008-296		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
	MW-2	12/18/01	4800-011218-256		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		12/18/01	4800-011218-256	X	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		3/26/02	4800-020326-266		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		7/1/02	4800-020701-282		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		7/1/02	4800-020701-282-DUP	X	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		10/8/02	4800-021008-297		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.2 J
	MW-3	12/18/01	4800-011218-255		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		3/27/02	4800-020327-267		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		7/2/02	4800-020702-283		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		10/8/02	4800-021008-298		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
	MW-4	12/18/01	4800-011218-254		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		3/27/02	4800-020327-268		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	1.2	0.5 U	2 U	0.5 U	0.64
		7/2/02	4800-020702-284		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.65	0.5 U	2 U	0.5 U	0.5 U
		10/8/02	4800-021008-299		0.5 U	0.5 U	0.24 J	0.5 U	0.5 U	0.5 U	20 U	1.1	0.5 U	2 U	0.26 J	0.63
		3/26/03	4800-030326-403-upper		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.65	0.5 U	2 U	0.5 U	0.5 U
		3/36/03	4800-030326-404-upper	X	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.61	0.5 U	2 U	0.5 U	0.5 U
		3/26/03	4800-030326-405-lower		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	1.0	0.5 U	2 U	0.5 U	0.5 U
		12/3/03	4800-031203-415		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.54	0.5 U	2 U	0.5 U	0.5 U
		12/3/03	4800-031203-415	X	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.57	1.4	2 U	0.5 U	0.5 U
Paint Shed/Blast Booth, Building 73 Area	MW-5	12/18/01	4800-011218-257		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		3/27/02	4800-020327-269		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		7/2/02	4800-020702-285		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		10/8/02	4800-021008-300		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
	MW-6	12/18/01	4800-011218-258		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		3/27/02	4800-020327-270		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		7/2/02	4800-020702-286		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		10/8/02	4800-021008-301		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
	MW-7	12/18/01	4800-011218-259		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		3/28/02	4800-020328-272		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		3/28/02	4800-020328-273	X	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		7/2/02	4800-020702-287		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		10/9/02	4800-021009-303		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U

Table 3
2003 Annual Groundwater Sampling Results
Volatile Organic Compound (VOC) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Dichlorodifluoromethane (CFC 12)	Chloromethane	Vinyl Chloride	Bromomethane	Chloroethane	Trichlorofluoromethane (CFC 11)	Acetone	1,1-Dichloroethene (1,1-DCE)	Carbon Disulfide	Dichloromethane (Methylene Chloride)	trans-1,2-Dichloroethene	1,1-Dichloroethane (1,1-DCA)
Human Health Consumption AWQC [a]					*NC*	*NC*	*530*	*NC*	*NC*	*NC*	*NC*	*3.2*	*NC*	*590*	*140,000*	*NC*
Risk-Based Concentration [b]					*NC*	*NC*	*840*	*NC*	*NC*	*NC*	*NC*	*330,000*	*NC*	*NC*	*390,000*	*NC*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*1,500*	*25*	*0.92*	*2,200*	*590*	*47*
Building 4 Area	MW-8	12/19/01	4800-011219-263		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		3/28/02	4800-020328-274		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		7/3/02	4800-0207-03-290		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		10/9/02	4800-021009-304		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		10/9/02	4800-021009-305	X	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
	MW-9	12/19/01	4800-011219-262		0.5 U	0.5 U	0.5 U	0.5 U	0.85	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		3/28/02	4800-020328-275		0.5 U	0.5 U	0.5 U	0.5 U	0.88	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		7/3/02	4800-0207-03-291		0.5 U	0.5 U	0.5 U	0.5 U	0.91	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		10/9/02	4800-021009-306		0.5 U	0.5 U	0.5 U	0.5 U	0.45 J	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
Building 43, 50 and 80 Area	MW-10	12/19/01	4800-011219-261		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		3/28/02	4800-020328-276		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		7/3/02	4800-0207-03-292		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		10/9/02	4800-021009-307		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
N. Channel Avenue Fabrication Site	MW-11	12/18/01	4800-011218-252		0.5 U	0.5 U	3.9	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
		4/10/02	4800-020410-278		0.5 U	0.5 U	6.5	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		7/3/02	4800-0207-03-293		0.5 U	0.5 U	1.3	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
		10/9/02	4800-021009-308		0.5 U	0.5 U	6.2	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.32 J	0.5 U
	EB	12/19/02	4800-011219-260		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	4.7	0.5 U	0.5 U
	EB	3/28/02	4800-020328-271		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
	EB	7/3/02	4800-0207-03-289		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
	EB	10/9/02	4800-021009-302		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.2 J	2 U	0.5 U	0.5 U
	EB	3/27/03	4800-030327-409		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U
	EB	12/3/03	4800-031203-416		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	2 U	0.5 U	0.5 U

U = not detected
EB = equipment blank
D = reported result is from a dilution
[a]EPA National Recommended Water Quality Criteria: 2002, Protection of Human Health from Organism Consumption Only, November 2002.
[b]DEQ RBC for vapor intrusion into buildings from DEQ's Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites, September 22, 2003.
[c]EPA National Recommended Water Quality Criteria: 2002, Protection of Freshwater Aquatic Organisms, Criterion Continuous Concentration (CCC), November 2002.
[d]DEQ Level II Screening Level Values (SLVs), December 2001.
NA = not analyzed
NC= no criteria or screening level
Shading indicates sampling result exceeds RBC or protection of human health AWQC.
Box indicates result exceeds protection of freshwater aquatic organisms AWQC or SLV.

Table 3
2003 Annual Groundwater Sampling Results
Volatile Organic Compound (VOC) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	2-Butanone (MEK)	2,2-Dichloropropane	cis-1,2-Dichloroethene	Chloroform	Bromochloromethane	1,1,1-Trichloroethane (TCA)	1,1-Dichloropropene	Carbon Tetrachloride	1,2-Dichloroethane (EDC)	Benzene
Human Health Consumption AWQC [a]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*1.6*	*37*	*51*
Risk-Based Concentration [b]					*NC*	*NC*	*410,000*	*NC*	*NC*	*>1,330,000*	*NC*	*NC*	*3,600*	*2,700*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*14,000*	*NC*	*590*	*1,240*	*NC*	*11*	*NC*	*74*	*20,000*	*130*
BWTP and Building 72 Area	MW-1	12/18/01	4800-011218-253		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/26/02	4800-020326-265		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		7/1/02	4800-020701-281		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		10/8/02	4800-021008-296		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	MW-2	12/18/01	4800-011218-256		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		12/18/01	4800-011218-256	X	20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/26/02	4800-020326-266		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		7/1/02	4800-020701-282		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		7/1/02	4800-020701-282-DUP	X	20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		10/8/02	4800-021008-297		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	MW-3	12/18/01	4800-011218-255		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/27/02	4800-020327-267		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		7/2/02	4800-020702-283		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		10/8/02	4800-021008-298		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	MW-4	12/18/01	4800-011218-254		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/27/02	4800-020327-268		20 U	0.5 U	1.9	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		7/2/02	4800-020702-284		20 U	0.5 U	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		10/8/02	4800-021008-299		20 U	0.5 U	1.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.11 J
		3/26/03	4800-030326-403-upper		20 U	0.5 U	0.79	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/36/03	4800-030326-404-upper	X	20 U	0.5 U	0.79	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/26/03	4800-030326-405-lower		20 U	0.5 U	1.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		12/3/03	4800-031203-415		20 U	0.5 U	0.93	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		12/3/03	4800-031203-415	X	20 U	0.5 U	0.98	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Paint Shed/Blast Booth, Building 73 Area	MW-5	12/18/01	4800-011218-257		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/27/02	4800-020327-269		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		7/2/02	4800-020702-285		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		10/8/02	4800-021008-300		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	MW-6	12/18/01	4800-011218-258		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/27/02	4800-020327-270		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		7/2/02	4800-020702-286		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		10/8/02	4800-021008-301		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	MW-7	12/18/01	4800-011218-259		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/28/02	4800-020328-272		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/28/02	4800-020328-273	X	20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		7/2/02	4800-020702-287		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		10/9/02	4800-021009-303		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.12 J

Table 3
2003 Annual Groundwater Sampling Results
Volatile Organic Compound (VOC) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	2-Butanone (MEK)	2,2-Dichloropropane	cis-1,2-Dichloroethene	Chloroform	Bromochloromethane	1,1,1-Trichloroethane (TCA)	1,1-Dichloropropene	Carbon Tetrachloride	1,2-Dichloroethane (EDC)	Benzene
Human Health Consumption AWQC[a]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*1.6*	*37*	*51*
Risk-Based Concentration[b]					*NC*	*NC*	*410,000*	*NC*	*NC*	*>1,330,000*	*NC*	*NC*	*3,600*	*2,700*
Freshwater WQC[c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV[d]					*14,000*	*NC*	*590*	*1,240*	*NC*	*11*	*NC*	*74*	*20,000*	*130*
Building 4 Area	MW-8	12/19/01	4800-011219-263		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/28/02	4800-020328-274		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		7/3/02	4800-0207-03-290		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		10/9/02	4800-021009-304		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		10/9/02	4800-021009-305	X	20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	MW-9	12/19/01	4800-011219-262		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	6.3	0.5 U
		3/28/02	4800-020328-275		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5.7	0.5 U
		7/3/02	4800-0207-03-291		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	4.5	0.5 U
		10/9/02	4800-021009-306		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	4.1	0.5 U
Building 43, 50 and 80 Area	MW-10	12/19/01	4800-011219-261		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		3/28/02	4800-020328-276		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		7/3/02	4800-0207-03-292		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		10/9/02	4800-021009-307		20 U	0.5 U	0.18 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
N. Channel Avenue Fabrication Site	MW-11	12/18/01	4800-011218-252		20 U	0.5 U	6.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		4/10/02	4800-020410-278		20 U	0.5 U	11	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		7/3/02	4800-0207-03-293		20 U	0.5 U	8	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
		10/9/02	4800-021009-308		20 U	0.5 U	10	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	EB	12/19/02	4800-011219-260		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	EB	3/28/02	4800-020328-271		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	EB	7/3/02	4800-0207-03-289		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	EB	10/9/02	4800-021009-302		20 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	3.0	0.15 J
	EB	3/27/03	4800-030327-409		20 U	0.5 U	0.5 U	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	EB	12/3/03	4800-031203-416		20 U	0.5 U	0.5 U	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

U = not detected
EB = equipment blank
D = reported result is from a dilution
[a]EPA National Recommended Water Quality Criteria: 2002, Protection of Human Health from Organism Consumption Only, November 2002.
[b]DEQ RBC for vapor intrusion into buildings from DEQ's Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites, September 22, 2003.
[c]EPA National Recommended Water Quality Criteria: 2002, Protection of Freshwater Aquatic Organisms, Criterion Continuous Concentration (CCC), November 2002.
[d]DEQ Level II Screening Level Values (SLVs), December 2001.
NA = not analyzed
NC= no criteria or screening level
Shading indicates sampling result exceeds RBC or protection of human health AWQC.
Box indicates result exceeds protection of freshwater aquatic organisms AWQC or SLV.

Table 3
2003 Annual Groundwater Sampling Results
Volatile Organic Compound (VOC) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Trichloroethene (TCE)	1,2-Dichloropropane	Bromodichloromethane	Dibromomethane	2-Hexanone	cis-1,3-Dichloropropene	Toluene	trans-1,3-Dichloropropene	1,1,2-Trichloroethane	4-Methyl-2-pentanone (MIBK)	1,3-Dichloropropane
Human Health Consumption AWQC [a]					*30*	*15*	*NC*	*NC*	*NC*	*NC*	*200,000*	*NC*	*16*	*NC*	*NC*
Risk-Based Concentration [b]					*110*	*NC*	*NC*	*NC*	*NC*	*NC*	*2,500,000*	*NC*	*NC*	*NC*	*NC*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*21,900*	*5,700*	*NC*	*NC*	*99*	*NC*	*9.8*	*NC*	*9,400*	*170*	*NC*
BWTP and Building 72 Area	MW-1	12/18/01	4800-011218-253		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/26/02	4800-020326-265		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/1/02	4800-020701-281		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		10/8/02	4800-021008-296		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
	MW-2	12/18/01	4800-011218-256		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		12/18/01	4800-011218-256	X	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/26/02	4800-020326-266		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/1/02	4800-020701-282		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/1/02	4800-020701-282-DUP	X	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		10/8/02	4800-021008-297		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
	MW-3	12/18/01	4800-011218-255		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/27/02	4800-020327-267		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/2/02	4800-020702-283		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		10/8/02	4800-021008-298		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
	MW-4	12/18/01	4800-011218-254		270	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/27/02	4800-020327-268		160	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/2/02	4800-020702-284		91	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		10/8/02	4800-021008-299		120	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/26/03	4800-030326-403-upper		53 D	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/36/03	4800-030326-404-upper	X	53 D	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/26/03	4800-030326-405-lower		82 D	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		12/3/03	4800-031203-415		54	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		12/3/03	4800-031203-415	X	56	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
Paint Shed/Blast Booth, Building 73 Area	MW-5	12/18/01	4800-011218-257		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/27/02	4800-020327-269		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/2/02	4800-020702-285		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		10/8/02	4800-021008-300		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.29 J	0.5 U	0.5 U	20 U	0.5 U
	MW-6	12/18/01	4800-011218-258		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/27/02	4800-020327-270		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/2/02	4800-020702-286		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		10/8/02	4800-021008-301		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.17 J	0.5 U	0.5 U	20 U	0.5 U
	MW-7	12/18/01	4800-011218-259		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/28/02	4800-020328-272		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/28/02	4800-020328-273	X	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/2/02	4800-020702-287		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		10/9/02	4800-021009-303		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.44 J	0.5 U	0.5 U	20 U	0.5 U

Table 3
2003 Annual Groundwater Sampling Results
Volatile Organic Compound (VOC) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Trichloroethene (TCE)	1,2-Dichloropropane	Bromodichloromethane	Dibromomethane	2-Hexanone	cis-1,3-Dichloropropene	Toluene	trans-1,3-Dichloropropene	1,1,2-Trichloroethane	4-Methyl-2-pentanone (MIBK)	1,3-Dichloropropane
Human Health Consumption AWQC [a]					*30*	*15*	*NC*	*NC*	*NC*	*NC*	*200,000*	*NC*	*16*	*NC*	*NC*
Risk-Based Concentration [b]					*110*	*NC*	*NC*	*NC*	*NC*	*NC*	*2,500,000*	*NC*	*NC*	*NC*	*NC*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*21,900*	*5,700*	*NC*	*NC*	*99*	*NC*	*9.8*	*NC*	*9,400*	*170*	*NC*
Building 4 Area	MW-8	12/19/01	4800-011219-263		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/28/02	4800-020328-274		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/3/02	4800-0207-03-290		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		10/9/02	4800-021009-304		0.12 J	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.13 J	0.5 U	0.5 U	20 U	0.5 U
		10/9/02	4800-021009-305	X	0.12 J	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.12 J	0.5 U	0.5 U	20 U	0.5 U
	MW-9	12/19/01	4800-011219-262		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/28/02	4800-020328-275		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/3/02	4800-0207-03-291		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		10/9/02	4800-021009-306		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
Building 43, 50 and 80 Area	MW-10	12/19/01	4800-011219-261		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		3/28/02	4800-020328-276		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/3/02	4800-0207-03-292		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.9	0.5 U	0.5 U	20 U	0.5 U
		10/9/02	4800-021009-307		0.14 J	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
N. Channel Avenue Fabrication Site	MW-11	12/18/01	4800-011218-252		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		4/10/02	4800-020410-278		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
		7/3/02	4800-0207-03-293		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.76	0.5 U	0.5 U	20 U	0.5 U
		10/9/02	4800-021009-308		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
	EB	12/19/02	4800-011219-260		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
	EB	3/28/02	4800-020328-271		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
	EB	7/3/02	4800-0207-03-289		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
	EB	10/9/02	4800-021009-302		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.44 J	0.5 U	0.5 U	20 U	0.5 U
	EB	3/27/03	4800-030327-409		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U
	EB	12/3/03	4800-031203-416		0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U	0.5 U	0.5 U	0.5 U	20 U	0.5 U

U = not detected
EB = equipment blank
D = reported result is from a dilution
[a]EPA National Recommended Water Quality Criteria: 2002, Protection of Human Health from Organism Consumption Only, November 2002.
[b]DEQ RBC for vapor intrusion into buildings from DEQ's Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites, September 22, 2003.
[c]EPA National Recommended Water Quality Criteria: 2002, Protection of Freshwater Aquatic Organisms, Criterion Continuous Concentration (CCC), November 2002.
[d]DEQ Level II Screening Level Values (SLVs), December 2001.
NA = not analyzed
NC= no criteria or screening level
Shading indicates sampling result exceeds RBC or protection of human health AWQC.
Box indicates result exceeds protection of freshwater aquatic organisms AWQC or SLV.

Table 3
2003 Annual Groundwater Sampling Results
Volatile Organic Compound (VOC) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Tetrachloroethene (PCE)	Dibromochloromethane	1,2-Dibromoethane (EDB)	Chlorobenzene	1,1,1,2-Tetrachloroethane	Ethylbenzene	m,p-Xylenes	o-Xylene	Styrene	Bromoform	Isopropylbenzene
Human Health Consumption AWQC [a]					*3.3*	*NC*	*NC*	*21,000*	*NC*	*29,000*	*NC*	*NC*	*NC*	*360*	*NC*
Risk-Based Concentration [b]					*1,300*	*NC*	*1,800*	*NC*	*NC*	*6,400,000*	*710,000*	*710,000*	*NC*	*NC*	*1,500,000*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*840*	*NC*	*NC*	*50*	*186*	*7.3*	*1.8*	*NC*	*NC*	*NC*	*NC*
BWTP and Building 72 Area	MW-1	12/18/01	4800-011218-253		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/26/02	4800-020326-265		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/1/02	4800-020701-281		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/8/02	4800-021008-296		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
	MW-2	12/18/01	4800-011218-256		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		12/18/01	4800-011218-256	X	0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/26/02	4800-020326-266		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/1/02	4800-020701-282		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/1/02	4800-020701-282-DUP	X	0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/8/02	4800-021008-297		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
	MW-3	12/18/01	4800-011218-255		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/27/02	4800-020327-267		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/2/02	4800-020702-283		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/8/02	4800-021008-298		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
	MW-4	12/18/01	4800-011218-254		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/27/02	4800-020327-268		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/2/02	4800-020702-284		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/8/02	4800-021008-299		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/26/03	4800-030326-403-upper		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/36/03	4800-030326-404-upper	X	0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/26/03	4800-030326-405-lower		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		12/3/03	4800-031203-415		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		12/3/03	4800-031203-415	X	0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
Paint Shed/Blast Booth, Building 73 Area	MW-5	12/18/01	4800-011218-257		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/27/02	4800-020327-269		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/2/02	4800-020702-285		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/8/02	4800-021008-300		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
	MW-6	12/18/01	4800-011218-258		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/27/02	4800-020327-270		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/2/02	4800-020702-286		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/8/02	4800-021008-301		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
	MW-7	12/18/01	4800-011218-259		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/28/02	4800-020328-272		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/28/02	4800-020328-273	X	0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/2/02	4800-020702-287		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/9/02	4800-021009-303		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.39 J	0.09 J	0.5 U	0.5 U	2 U

Table 3
2003 Annual Groundwater Sampling Results
Volatile Organic Compound (VOC) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Tetrachloroethene (PCE)	Dibromochloromethane	1,2-Dibromoethane (EDB)	Chlorobenzene	1,1,1,2-Tetrachloroethane	Ethylbenzene	m,p-Xylenes	o-Xylene	Styrene	Bromoform	Isopropylbenzene
Human Health Consumption AWQC [a]					*3.3*	*NC*	*NC*	*21,000*	*NC*	*29,000*	*NC*	*NC*	*NC*	*360*	*NC*
Risk-Based Concentration [b]					*1,300*	*NC*	*1,800*	*NC*	*NC*	*6,400,000*	*710,000*	*710,000*	*NC*	*NC*	*1,500,000*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*840*	*NC*	*NC*	*50*	*186*	*7.3*	*1.8*	*NC*	*NC*	*NC*	*NC*
Building 4 Area	MW-8	12/19/01	4800-011219-263		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/28/02	4800-020328-274		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/3/02	4800-0207-03-290		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/9/02	4800-021009-304		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/9/02	4800-021009-305	X	0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
	MW-9	12/19/01	4800-011219-262		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/28/02	4800-020328-275		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/3/02	4800-0207-03-291		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/9/02	4800-021009-306		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
Building 43, 50 and 80 Area	MW-10	12/19/01	4800-011219-261		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		3/28/02	4800-020328-276		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/3/02	4800-0207-03-292		0.78	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/9/02	4800-021009-307		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
N. Channel Avenue Fabrication Site	MW-11	12/18/01	4800-011218-252		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		4/10/02	4800-020410-278		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		7/3/02	4800-0207-03-293		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
		10/9/02	4800-021009-308		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
	EB	12/19/02	4800-011219-260		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
	EB	3/28/02	4800-020328-271		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
	EB	7/3/02	4800-0207-03-289		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
	EB	10/9/02	4800-021009-302		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.22 J	0.13 J	0.5 U	0.5 U	2 U
	EB	3/27/03	4800-030327-409		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U
	EB	12/3/03	4800-031203-416		0.5 U	0.5 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2 U

U = not detected
EB = equipment blank
D = reported result is from a dilution
[a]EPA National Recommended Water Quality Criteria: 2002, Protection of Human Health from Organism Consumption Only, November 2002.
[b]DEQ RBC for vapor intrusion into buildings from DEQ's Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites, September 22, 2003.
[c]EPA National Recommended Water Quality Criteria: 2002, Protection of Freshwater Aquatic Organisms, Criterion Continuous Concentration (CCC), November 2002.
[d]DEQ Level II Screening Level Values (SLVs), December 2001.
NA = not analyzed
NC= no criteria or screening level
Shading indicates sampling result exceeds RBC or protection of human health AWQC.
Box indicates result exceeds protection of freshwater aquatic organisms AWQC or SLV.

Table 3
2003 Annual Groundwater Sampling Results
Volatile Organic Compound (VOC) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	1,1,2,2-Tetrachloroethane	1,2,3-Trichloropropane	Bromobenzene	n-Propylbenzene	2-Chlorotoluene	4-Chlorotoluene	1,3,5-Trimethylbenzene	tert-Butylbenzene	1,2,4-Trimethylbenzene	sec-Butylbenzene	1,3-Dichlorobenzene
Human Health Consumption AWQC [a]					*4*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
Risk-Based Concentration [b]					*NC*	*NC*	*NC*	*540,000*	*NC*	*NC*	*38,000*	*NC*	*51,000*	*NC*	*NC*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*2,400*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*71*
BWTP and Building 72 Area	MW-1	12/18/01	4800-011218-253		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/26/02	4800-020326-265		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/1/02	4800-020701-281		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/8/02	4800-021008-296		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	MW-2	12/18/01	4800-011218-256		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		12/18/01	4800-011218-256	X	0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/26/02	4800-020326-266		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/1/02	4800-020701-282		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/1/02	4800-020701-282-DUP	X	0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/8/02	4800-021008-297		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	MW-3	12/18/01	4800-011218-255		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/27/02	4800-020327-267		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/2/02	4800-020702-283		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/8/02	4800-021008-298		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	MW-4	12/18/01	4800-011218-254		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/27/02	4800-020327-268		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/2/02	4800-020702-284		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/8/02	4800-021008-299		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/26/03	4800-030326-403-upper		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/36/03	4800-030326-404-upper	X	0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/26/03	4800-030326-405-lower		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		12/3/03	4800-031203-415		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		12/3/03	4800-031203-415	X	0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
Paint Shed/Blast Booth, Building 73 Area	MW-5	12/18/01	4800-011218-257		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/27/02	4800-020327-269		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/2/02	4800-020702-285		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/8/02	4800-021008-300		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	MW-6	12/18/01	4800-011218-258		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/27/02	4800-020327-270		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/2/02	4800-020702-286		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/8/02	4800-021008-301		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	MW-7	12/18/01	4800-011218-259		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/28/02	4800-020328-272		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/28/02	4800-020328-273	X	0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/2/02	4800-020702-287		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/9/02	4800-021009-303		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U

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Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	1,1,2,2-Tetrachloroethane	1,2,3-Trichloropropane	Bromobenzene	n-Propylbenzene	2-Chlorotoluene	4-Chlorotoluene	1,3,5-Trimethylbenzene	tert-Butylbenzene	1,2,4-Trimethylbenzene	sec-Butylbenzene	1,3-Dichlorobenzene
Human Health Consumption AWQC[a]					*4*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
Risk-Based Concentration[b]					*NC*	*NC*	*NC*	*540,000*	*NC*	*NC*	*38,000*	*NC*	*51,000*	*NC*	*NC*
Freshwater WQC[c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV[d]					*2,400*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*71*
Building 4 Area	MW-8	12/19/01	4800-011219-263		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/28/02	4800-020328-274		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/3/02	4800-0207-03-290		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/9/02	4800-021009-304		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/9/02	4800-021009-305	X	0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	MW-9	12/19/01	4800-011219-262		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/28/02	4800-020328-275		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/3/02	4800-0207-03-291		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/9/02	4800-021009-306		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
Building 43, 50 and 80 Area	MW-10	12/19/01	4800-011219-261		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		3/28/02	4800-020328-276		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/3/02	4800-0207-03-292		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/9/02	4800-021009-307		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
N. Channel Avenue Fabrication Site	MW-11	12/18/01	4800-011218-252		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		4/10/02	4800-020410-278		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		7/3/02	4800-0207-03-293		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
		10/9/02	4800-021009-308		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	EB	12/19/02	4800-011219-260		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	EB	3/28/02	4800-020328-271		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	EB	7/3/02	4800-0207-03-289		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	EB	10/9/02	4800-021009-302		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	EB	3/27/03	4800-030327-409		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U
	EB	12/3/03	4800-031203-416		0.5 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U

U = not detected
EB = equipment blank
D = reported result is from a dilution
[a]EPA National Recommended Water Quality Criteria: 2002, Protection of Human Health from Organism Consumption Only, November 2002.
[b]DEQ RBC for vapor intrusion into buildings from DEQ's Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites, September 22, 2003.
[c]EPA National Recommended Water Quality Criteria: 2002, Protection of Freshwater Aquatic Organisms, Criterion Continuous Concentration (CCC), November 2002.
[d]DEQ Level II Screening Level Values (SLVs), December 2001.
NA = not analyzed
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Shading indicates sampling result exceeds RBC or protection of human health AWQC.
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Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	4-Isopropyltoluene	1,4-Dichlorobenzene	n-Butylbenzene	1,2-Dichlorobenzene	1,2-Dibromo-3-chloropropane (DBCP)	1,2,4-Trichlorobenzene	1,2,3-Trichlorobenzene	Naphthalene	Hexachlorobutadiene
Human Health Consumption AWQC[a]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
Risk-Based Concentration[b]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*350,000*	*NC*
Freshwater WQC[c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV[d]					*NC*	*15*	*NC*	*14*	*NC*	*110*	*NC*	*620*	*9.3*
BWTP and Building 72 Area	MW-1	12/18/01	4800-011218-253		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/26/02	4800-020326-265		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/1/02	4800-020701-281		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/8/02	4800-021008-296		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	MW-2	12/18/01	4800-011218-256		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		12/18/01	4800-011218-256	X	2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/26/02	4800-020326-266		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/1/02	4800-020701-282		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/1/02	4800-020701-282-DUP	X	2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/8/02	4800-021008-297		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	MW-3	12/18/01	4800-011218-255		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/27/02	4800-020327-267		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/2/02	4800-020702-283		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/8/02	4800-021008-298		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	MW-4	12/18/01	4800-011218-254		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/27/02	4800-020327-268		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/2/02	4800-020702-284		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/8/02	4800-021008-299		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/26/03	4800-030326-403-upper		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/36/03	4800-030326-404-upper	X	2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/26/03	4800-030326-405-lower		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		12/3/03	4800-031203-415		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		12/3/03	4800-031203-415	X	2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
Paint Shed/Blast Booth, Building 73 Area	MW-5	12/18/01	4800-011218-257		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/27/02	4800-020327-269		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/2/02	4800-020702-285		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/8/02	4800-021008-300		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	MW-6	12/18/01	4800-011218-258		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/27/02	4800-020327-270		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/2/02	4800-020702-286		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/8/02	4800-021008-301		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	MW-7	12/18/01	4800-011218-259		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/28/02	4800-020328-272		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/28/02	4800-020328-273	X	2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/2/02	4800-020702-287		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/9/02	4800-021009-303		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U

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Human Health Consumption AWQC [a]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
Risk-Based Concentration [b]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*350,000*	*NC*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*NC*	*15*	*NC*	*14*	*NC*	*110*	*NC*	*620*	*9.3*
Building 4 Area	MW-8	12/19/01	4800-011219-263		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/28/02	4800-020328-274		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/3/02	4800-0207-03-290		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/9/02	4800-021009-304		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/9/02	4800-021009-305	X	2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	MW-9	12/19/01	4800-011219-262		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/28/02	4800-020328-275		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/3/02	4800-0207-03-291		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/9/02	4800-021009-306		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
Building 43, 50 and 80 Area	MW-10	12/19/01	4800-011219-261		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		3/28/02	4800-020328-276		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/3/02	4800-0207-03-292		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/9/02	4800-021009-307		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
N. Channel Avenue Fabrication Site	MW-11	12/18/01	4800-011218-252		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		4/10/02	4800-020410-278		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		7/3/02	4800-0207-03-293		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
		10/9/02	4800-021009-308		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	EB	12/19/02	4800-011219-260		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	EB	3/28/02	4800-020328-271		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	EB	7/3/02	4800-0207-03-289		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	EB	10/9/02	4800-021009-302		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	EB	3/27/03	4800-030327-409		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U
	EB	12/3/03	4800-031203-416		2 U	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U	2 U

U = not detected
EB = equipment blank
D = reported result is from a dilution
[a]EPA National Recommended Water Quality Criteria: 2002, Protection of Human Health from Organism Consumption Only, November 2002.
[b]DEQ RBC for vapor intrusion into buildings from DEQ's Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites, September 22, 2003.
[c]EPA National Recommended Water Quality Criteria: 2002, Protection of Freshwater Aquatic Organisms, Criterion Continuous Concentration (CCC), November 2002.
[d]DEQ Level II Screening Level Values (SLVs), December 2001.
NA = not analyzed
NC= no criteria or screening level
Shading indicates sampling result exceeds RBC or protection of human health AWQC.
Box indicates result exceeds protection of freshwater aquatic organisms AWQC or SLV.

Table 4
2003 Annual Groundwater Sampling Results
Polynuclear Aromatic Hydrocarbon (PAH) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Naphthalene	2-Methylnaphthalene	Acenaphthylene	Acenaphthene	Dibenzofuran	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
Human Health Consumption AWQC [a]					*NC*	*NC*	*NC*	*990*	*NC*	*5,300*	*NC*	*40,000*	*140*	*4,000*
Risk-Based Concentration [b]					*350,000*	*NC*	*NC*	*1.1E+08*	*NC*	*2.0E+08*	*NC*	*1.6E+09*	*9.2E+08*	*1.1E+09*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*620*	*NC*	*NC*	*520*	*3.7*	*3.9*	*6.3*	*13*	*6.16*	*NC*
BWTP and Building 72 Area	MW-1	12/18/01	4800-011218-253		0.02 U	0.02	0.02 U	0.02 U	0.045	0.072	0.082	0.28	0.024	0.024
		3/26/02	4800-020326-265		0.02	0.02 U	0.02 U	0.022	0.026	0.056	0.2	0.38	0.044 B	0.059
		7/1/02	4800-020701-281		0.068	0.034	0.02 U	0.035	0.02 U	0.03	0.43	0.065	0.044	0.19
		10/8/02	4800-021008-296		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.036	0.15	0.14	0.12	0.16
		12/2/03	4800-031202-412		0.022	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.032	0.019 U	0.019 U	0.019 U
		12/2/03	4800-031202-412	X	0.025	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.032	0.019 U	0.019 U	0.019 U
	MW-2	12/18/01	4800-011218-256		0.02 U	0.02 U	0.02 U	0.02 U	0.022	0.02 U	0.02 U	0.02 U	0.02 U	0.035
		12/18/01	4800-011218-256	X	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.025
		3/26/02	4800-020326-266		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/1/02	4800-020701-282		0.055	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/1/02	4800-020701-282-DUP	X	0.039	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/8/02	4800-021008-297		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	MW-3	12/18/01	4800-011218-255		0.02 U	0.02 U	0.02 U	0.02 U	0.021	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/02	4800-020327-267		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.023	0.02 U	0.02 U
		7/2/02	4800-020702-283		0.057	0.028	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/8/02	4800-021008-298		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/26/03	4800-030326-402		0.15	0.036	0.02 U	0.02 U	0.02 U	0.02 U	0.031	0.02 U	0.02 U	0.02 U
	MW-4	12/18/01	4800-011218-254		0.02 U	0.02 U	0.02 U	0.02 U	0.03	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/02	4800-020327-268		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/2/02	4800-020702-284		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/8/02	4800-021008-299		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/26/03	4800-030326-403-upper		0.02	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/26/03	4800-030326-404-upper	X	0.024	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U
		3/26/03	4800-030326-405-lower		0.024	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Paint Shed/Blast Booth, Building 73 Area	MW-5	12/18/01	4800-011218-257		0.02 U	0.02 U	0.02 U	0.02 U	0.025	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/02	4800-020327-269		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/2/02	4800-020702-285		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/8/02	4800-021008-300		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	MW-6	12/18/01	4800-011218-258		0.02 U	0.02 U	0.02 U	0.02 U	0.026	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/02	4800-020327-270		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/2/02	4800-020702-286		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/8/02	4800-021008-301		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	MW-7	12/18/01	4800-011218-259		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/28/02	4800-020328-272		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/28/02	4800-020328-273	X	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/2/02	4800-020702-287		0.025	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/9/02	4800-021009-303		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/03	4800-030327-406		0.072	0.028	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U

Table 4
2003 Annual Groundwater Sampling Results
Polynuclear Aromatic Hydrocarbon (PAH) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Naphthalene	2-Methylnaphthalene	Acenaphthylene	Acenaphthene	Dibenzofuran	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
Human Health Consumption AWQC [a]					*NC*	*NC*	*NC*	*990*	*NC*	*5,300*	*NC*	*40,000*	*140*	*4,000*
Risk-Based Concentration [b]					*350,000*	*NC*	*NC*	*1.1E+08*	*NC*	*2.0E+08*	*NC*	*1.6E+09*	*9.2E+08*	*1.1E+09*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*620*	*NC*	*NC*	*520*	*3.7*	*3.9*	*6.3*	*13*	*6.16*	*NC*
Building 4 Area	MW-8	12/19/01	4800-011219-263		0.02 U	0.02 U	0.02 U	0.02 U	0.023	0.02 U	0.02 U	0.02 U	0.075	0.1
		3/28/02	4800-020328-274		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/3/02	4800-0207-03-290		0.031	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/9/02	4800-021009-304		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/9/02	4800-021009-305	X	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/03	4800-030327-407-upper		0.043	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.097	0.2
		3/27/03	4800-030327-408-lower		0.048	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		12/3/03	4800-031203-413		0.026	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
	MW-9	12/19/01	4800-011219-262		0.02 U	0.02 U	0.02 U	0.02 U	0.02	0.02 U	0.033	0.02 U	0.02 U	0.034
		3/28/02	4800-020328-275		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.023	0.02 U	0.02 U	0.02 U
		7/3/02	4800-0207-03-291		0.036	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.032	0.02 U	0.02 U	0.024
		10/9/02	4800-021009-306		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Building 43, 50 and 80 Area	MW-10	12/19/01	4800-011219-261		0.02 U	0.02 U	0.02 U	0.46	0.032	0.02 U	0.061	0.02 U	0.02 U	0.045
		3/28/02	4800-020328-276		0.02 U	0.02 U	0.02 U	1.2	0.02 U	0.02 U	0.12	0.02 U	0.02 U	0.032
		7/3/02	4800-0207-03-292		0.043	0.02 U	0.02 U	0.35	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.021
		10/9/02	4800-021009-307		0.02 U	0.02 U	0.02 U	0.85	0.02 U	0.02 U	0.032	0.02 U	0.02 U	0.048
N. Channel Avenue Fabrication Site	MW-11	12/18/01	4800-011218-252		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		4/10/02	4800-020410-278		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/3/02	4800-0207-03-293		0.093	0.029	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/9/02	4800-021009-308		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	12/19/02	4800-011219-260		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	3/28/02	4800-020328-271		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	7/3/02	4800-0207-03-289		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	10/9/02	4800-021009-302		0.087	0.037	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	3/27/03	4800-030327-409		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	12/3/03	4800-011203-416		0.05	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U

U = not detected
B = analyte found in associated method blank
EB = equipment blank
[a]EPA National Recommended Water Quality Criteria: 2002, Protection of Human Health from Organism Consumption Only, November 2002.
[b]DEQ RBC for vapor intrusion into buildings from DEQ's Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites, September 22, 2003.
[c]EPA National Recommended Water Quality Criteria: 2002, Protection of Freshwater Aquatic Organisms, Criterion Continuous Concentration (CCC), November 2002.
[d]DEQ Level II Screening Level Values (SLVs), December 2001.
NA = not analyzed
NC= no criteria or screening level
Shading indicates sampling result exceeds RBC or protection of human health AWQC.
Box indicates result exceeds protection of freshwater aquatic organisms AWQC or SLV.

Table 4
2003 Annual Groundwater Sampling Results
Polynuclear Aromatic Hydrocarbon (PAH) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene
Human Health Consumption AWQC [a]					*0.018*	*0.018*	*0.018*	*0.018*	*0.018*	*0.018*	*0.018*	*NC*
Risk-Based Concentration [b]					*230,000*	*1.9E+06*	*18,000*	*1.5E+07*	*68,000*	*1.1E+06*	*450,000*	*NC*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*0.027*	*NC*	*NC*	*NC*	*0.014*	*NC*	*NC*	*NC*
BWTP and Building 72 Area	MW-1	12/18/01	4800-011218-253		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/26/02	4800-020326-265		0.02 U	0.035 B	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/1/02	4800-020701-281		0.02 U	0.02 U	0.02 U	0.024	0.02 U	0.02 U	0.02 U	0.02 U
		10/8/02	4800-021008-296		0.12	0.1	0.1	0.089	0.096	0.092	0.086	0.093
		12/2/03	4800-031202-412		0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
		12/2/03	4800-031202-412	X	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
	MW-2	12/18/01	4800-011218-256		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		12/18/01	4800-011218-256	X	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/26/02	4800-020326-266		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/1/02	4800-020701-282		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/1/02	4800-020701-282-DUP	X	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/8/02	4800-021008-297		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	MW-3	12/18/01	4800-011218-255		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/02	4800-020327-267		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/2/02	4800-020702-283		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/8/02	4800-021008-298		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/26/03	4800-030326-402		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	MW-4	12/18/01	4800-011218-254		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/02	4800-020327-268		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/2/02	4800-020702-284		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/8/02	4800-021008-299		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/26/03	4800-030326-403-upper		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/26/03	4800-030326-404-upper	X	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U
		3/26/03	4800-030326-405-lower		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Paint Shed/Blast Booth, Building 73 Area	MW-5	12/18/01	4800-011218-257		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/02	4800-020327-269		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/2/02	4800-020702-285		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/8/02	4800-021008-300		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	MW-6	12/18/01	4800-011218-258		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/02	4800-020327-270		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/2/02	4800-020702-286		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/8/02	4800-021008-301		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	MW-7	12/18/01	4800-011218-259		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/28/02	4800-020328-272		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/28/02	4800-020328-273	X	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/2/02	4800-020702-287		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/9/02	4800-021009-303		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/03	4800-030327-406		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U

Table 4
2003 Annual Groundwater Sampling Results
Polynuclear Aromatic Hydrocarbon (PAH) Concentrations in Groundwater (ug/L)
Portland Shipyard (PSY) Remedial Investigation

Area of Investigation	Monitoring Well	Date	Sample No.	Duplicate	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene
Human Health Consumption AWQC [a]					*0.018*	*0.018*	*0.018*	*0.018*	*0.018*	*0.018*	*0.018*	*NC*
Risk-Based Concentration [b]					*230,000*	*1.9E+06*	*18,000*	*1.5E+07*	*68,000*	*1.1E+06*	*450,000*	*NC*
Freshwater WQC [c]					*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
SLV [d]					*0.027*	*NC*	*NC*	*NC*	*0.014*	*NC*	*NC*	*NC*
Building 4 Area	MW-8	12/19/01	4800-011219-263		0.031	0.047	0.034	0.033	0.049	0.04	0.02 U	0.052
		3/28/02	4800-020328-274		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/3/02	4800-0207-03-290		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/9/02	4800-021009-304		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/9/02	4800-021009-305	X	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/27/03	4800-030327-407-upper		0.043	0.085	0.088	0.074	0.093	0.11	0.02 U	0.13
		3/27/03	4800-030327-408-lower		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		12/3/03	4800-031203-413		0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
	MW-9	12/19/01	4800-011219-262		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/28/02	4800-020328-275		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/3/02	4800-0207-03-291		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02
		10/9/02	4800-021009-306		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Building 43, 50 and 80 Area	MW-10	12/19/01	4800-011219-261		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		3/28/02	4800-020328-276		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/3/02	4800-0207-03-292		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		10/9/02	4800-021009-307		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
N. Channel Avenue Fabrication Site	MW-11	12/18/01	4800-011218-252		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		4/10/02	4800-020410-278		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
		7/3/02	4800-0207-03-293		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02
		10/9/02	4800-021009-308		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	12/19/02	4800-011219-260		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	3/28/02	4800-020328-271		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	7/3/02	4800-0207-03-289		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	10/9/02	4800-021009-302		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	3/27/03	4800-030327-409		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
	EB	12/3/03	4800-011203-416		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U

U = not detected
B = analyte found in associated method blank
EB = equipment blank
[a]EPA National Recommended Water Quality Criteria: 2002, Protection of Human Health from Organism Consumption Only, November 2002.
[b]DEQ RBC for vapor intrusion into buildings from DEQ's Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites, September 22, 2003.
[c]EPA National Recommended Water Quality Criteria: 2002, Protection of Freshwater Aquatic Organisms, Criterion Continuous Concentration (CCC), November 2002.
[d]DEQ Level II Screening Level Values (SLVs), December 2001.
NA = not analyzed
NC= no criteria or screening level
Shading indicates sampling result exceeds RBC or protection of human health AWQC.
Box indicates result exceeds protection of freshwater aquatic organisms AWQC or SLV.

Appendix A-4

Foss Maritime/Brix Marine

FOSS MARITIME CO./BRIX MARITIME CO.

Oregon DEQ ECSI #: 2364

9030 NW St. Helens Road
DEQ Site Mgr: Dana Bayuk
Latitude: 45.5877°
Longitude: -122.7713°
Township/Range/Section: 1N/1W/11

River Mile: 5.7 West bank

LWG Member ☐ Yes ☒ No

Upland Analytical Data Status: ☐ Electronic Data Available ☒ Hardcopies only

1. SUMMARY OF POTENTIAL CONTAMINANT TRANSPORT PATHWAYS TO THE RIVER

The current understanding of the transport mechanism of contaminants from the uplands portions of the site to the river is summarized in this section and Table 1, and supported in the following sections.

1.1. *Overland Transport*

Overland transport of contaminated soil is minimized by the presence of pavement or buildings, which cover the entire site, and of riprap that armors the riverbank (Anchor and HAI 2000). However, overland transport of contaminants released to surface pavement during site operations may be possible. Possible spills in the drum storage area or from the utility-owned transformers may be sources of contaminants that could be transported by overland flow to the river.

1.2. *Riverbank Erosion*

Erosion of the riverbank is reduced by the presence of riprap armoring.

1.3. *Groundwater*

The shallow aquifer discharges to the river along the top of the silt aquitard, visible at the river's edge during low river stage. Releases of petroleum hydrocarbons have created a dissolved plume beneath the site (with occasional measurable NAPL present). A historic natural drainage feature in the southern half of the site may locally influence shallow groundwater flow directions in this part of the site. Low level hydrocarbon constituents have been detected in the downgradient-near river monitoring well (MW-4).

1.4. *Direct Discharge (Overwater Activities and Stormwater/Wastewater Systems)*

Overwater activities at the Brix site include maintenance activities performed at the covered barge permanently moored at the facility dock. Several documented releases have occurred to the river at the site, both from maintenance activities and discharges from moored vessels (Anchor and HAI 2000).

Stormwater drains through five catch basins on the site that discharge through private outfalls to the Willamette River.

1.5. *Relationship of Upland Sources to River Sediments*

See Final CSM Update.

1.6. *Sediment Transport*

The Foss Maritime/Brix Marine property is located on the west side of the river at approximately RM 5.7. This is within the relatively narrow river reach from RM 5 to 7 that is characterized as a transport/non-depositional zone based on the site physical information compiled in the Programmatic Work Plan (Integral et al. 2004). The Sediment Trend Analysis® results indicate that sediment movement along this side of the river alternates between net accretion and net deposition, transitioning to dynamic equilibrium in the center and east of the channel. The measured bathymetric changes over the 25-month period from January 2002 through February 2004 (Integral and DEA in prep) show a complex mosaic of no change and sediment accretion and scour on the order of 1 foot in extent in the nearshore area around the site's dock structures above the –15 NAVD88 contour. From the –15 NAVD88 contour to full channel depth, the riverbed shows no measurable elevation change. In the center of main channel offshore of the site, areas of small-scour and no change predominate and are interspersed.

2. CSM SITE SUMMARY REVISIONS

Date of Last Revision: September 15, 2004

3. PROJECT STATUS

Activity		Date(s)/Comments
PA/XPA	☒	XPA (Anchor and HAI 2000); Sampling to support the XPA was performed in May-June 2001.
RI	☒	RI Work Plan (Anchor 2003) submitted to DEQ 11/26/03
FS	☐	
Interim Action/Source Control	☐	
ROD	☐	
RD/RA	☐	
NFA	☐	

DEQ Portland Harbor Site Ranking (Tier 1, 2, or 3): 2

4. SITE OWNER HISTORY

Owner/Occupant	Type of Operation	Years
Brix Maritime (a subsidiary of Foss Maritime Company)	Marine vessel transportation services and maintenance	1993 - present
Knappton Corporation	Tugboat service and fueling	1979 – 1993

5. PROPERTY DESCRIPTION

The Foss Maritime Company/Brix Maritime Company (Brix) site is located in an industrial area along the west bank of the Willamette River, at RM 5.7 (Figure 1; DEQ 1999). Based on aerial photographs observed by Integral, the nearest residences appear to be located approximately 0.2 miles from the site (DEQ 2004a). Brix property includes two parcels, one adjacent to the river, and a small separate parcel to the south across the access road and adjacent railroad tracks (Figure 1). This second parcel appears to be undeveloped, and no additional information is available regarding it; therefore, this parcel will not be discussed here. The riverfront property is located at approximately 40 feet above mean sea level (Anchor 2003). The topography of the site dips gently to the north to a rip-rap-armored embankment along the Willamette River, which borders the property to the east (Anchor and HAI 2000). The 4.5-acre parcel is fenced and entirely paved except for the 510-foot-long riverbank (Anchor 2003; Foss Maritime Company 1999). The Brix property is bordered by a vacant property to the south, a service drive, utility right-of-way, and railroad spur to the west, and Shore Oil Company to the north.

Details of the property facilities are provided in Anchor and HAI (2000). The facility includes two primary structures: a two-story office building, and a maintenance office building. A 'general stores' building, an outdoor storage area, small storage sheds, a dock, and a permanently moored covered maintenance barge also exist at the site (Anchor and HAI 2000).

Three underground storage tanks (USTs) are active at the site, located near the maintenance department office building (DEQ 2004b; Anchor and HAI 2000). Two of the tanks are used to store diesel, and the third is used to store lubricating oil (Anchor and HAI 2000). The contents of all three tanks are piped through underground and aboveground piping to a fueling station located on the moored barge (Anchor and HAI 2000). The neighboring Shore Oil Company facility includes numerous aboveground storage tanks (ASTs; Anchor and HAI 2000).

Five private storm water outfalls have been mapped by the City of Portland (Figure 1). The facility reports five stormwater catch basins that discharge through two private outfalls at the river bank (see Supplemental Figure 2; Anchor and HAI 2000). The nature of the three other outfall shown on Figure 1 are not addressed in the references cited.

Storm water outfall 22D (WR 210, Figure 1) formerly existed on the property. The piping for the outfall historically ran under the main office building. Due to the collapse of the pipe, the City requested an easement and installed a new connection and outfall pipe (WR 212, Figure 1) on the northwest boundary of the Foss property in the summer of 1999. The old connection was plugged, and the former outfall was abandoned in place (Anchor and HAI 2000).

Two pad-mounted electrical transformers owned by the utility are located onsite, east of the storage buildings and south of the office building (Anchor and HAI 2000). The transformer east of the storage building was labeled as containing nonregulated levels of PCBs. The transformer south of the office building was not labeled. The potential for PCBs in this transformer is currently being evaluated by Brix (Dana Bayuk, pers. comm. September 2,02004) Both transformers were reported to be in good condition (Anchor and HAI 2000).

Foss, through care of the Siegfried Company, has a submerged and submersible land lease with the State of Oregon Division of State Lands: ML-9230 (Anchor and HAI 2000). This lease delineates a 2.05-acre area of the river from the ordinary low water line at each corner of the property tax lot (39), 175 feet into the channel, and along the 510-foot river frontage. The lease took effect May 1,1990 and expired April 30, 2000, at which time it reverted to a year-to-year basis (Anchor and HAI 2001). The leased area is shown in Supplemental Figure, Exhibit A.

6. CURRENT SITE USE

Since the site was first developed in 1979, it has been operated as a dispatch and coordination facility for the Brix Maritime Company boat fleet (Anchor and HAI 2000). In addition, minor repairs to small engines and equipment, and onloading and offloading of lubrication oil from tugboats is performed on site. Brix became a wholly-owned subsidiary of Foss Maritime Company (Foss) in 1993, and owns and operates the facility under a license to use the Foss name (Anchor and HAI 2001).

During site operations, diesel and clean lubricating oil are pumped from USTs located near the maintenance office building to tugs moored at the docks near the maintenance barge (Anchor and HAI 2000). Waste oil and bilge fluids are pumped off the tugs to a large tank on the barge. The wastes are removed by a pump truck and transported to a waste oil recycling facility (Anchor and HAI 2000).

The general stores building is used to store parts, tools, and small quantities of paints and cleaners, and the small storage sheds are used to store compressed gases (Anchor and HAI 2000). An asphalt-paved outdoor drum storage area was reported along the southeastern corner of the property; approximately twenty-one 55-gallon steel drums on wooden pallets were reported during a site visit in 2000 (Anchor and HAI 2000). The drums were observed to be labeled and secured, and no leaks or spills were observed at or in the vicinity of the drums (Anchor and HAI 2000). Subsequent to site visit by the City of Portland, the drum storage area was relocated inside the maintenance building in 2000. The facility is listed as a RCRA conditionally exempt generator (CEG) of hazardous waste, reportedly based on a one-time disposal at an off-site disposal facility of old paint that had accumulated onsite (Anchor and HAI 2001). DEQ records indicate the facility disposed of 480 lbs of "organic paint, ink, lacquer or varnish" in 1994 (DEQ 2004c).

A list of materials stored and used on site, and an estimate of average quantities present, and the storage locations as of September 2001 include (Anchor and HAI 2001):

- Hydraulic fluid (40 gallons), in warehouse
- Antifreeze (12 gallons), in warehouse storage room
- Paint/thinner (80 gallons), in warehouse
- Gasoline (20 gallons, not including UST), in warehouse
- Kerosene (55 gallons) in parts cleaner in shop barge
- Nalcool (40 gallons), in warehouse
- 40-wt Oil (40 gallons), in warehouse
- AC 500 (acid-based cleaner, 16 gallons), in warehouse storage room.

All potentially hazardous wastes generated at the site are recycled at DEQ-approved facilities (Anchor and HAI 2000).

7. SITE USE HISTORY

The site appears to have remained undeveloped until 1979, though some infilling of the northeastern portion of the property was evident in historical aerial photos by 1955 (Anchor and HAI 2000). The property was vegetated prior to development. A small stream appears in a 1961 aerial photo that crossed through the center of the property from east to west. Based on an aerial photo observed by Integral, the two existing buildings, the parking lot, and the permanent barge on the Willamette River are current surface features that were present onsite by 1980 (Anchor and HAI 2000).

UST records on file with the City of Portland Bureau of Environmental Services (BES) and/or Portland Fire Bureau indicate five USTs were installed on the property in 1979; Knappton Tugboat Company was listed as the operator at that time (Anchor and HAI 2000). The tanks were installed in a single tank nest near the maintenance building, and included one 6,000-gallon gasoline UST (UST #2), two 6,000-gallon lube oil USTs (#1 and #3; containing 30-weight and 40-weight oil, respectively), and two 20,000-gallon diesel USTs (#4 and #5; Anchor 2000). The DEQ Facility Identification Number is #7374 (Anchor 2000). USTs #1 and #2 were decommissioned at the property in 1998, and the systems of three of the existing USTs were upgraded to include tank lining, spill and overfill protection, tank monitoring detectors, and new (rerouted) piping (Anchor 2000; Anchor and HAI 2000).

A release from the 30-weight lube oil transfer lines was reported to DEQ in January 1993 [file number 26-93-009; Anchor and HAI (2000)]. During the investigation of the oil release, diesel contamination of subsurface soil was discovered. Approximately 45 cubic yards of contaminated soil was excavated from the impacted area, and free product was pumped from the excavation. "Oil" was also observed seeping from the walls of the excavation (DEQ 2001, pers. comm.). No groundwater was encountered (Anchor and HAI 2000). The soil was transported offsite for thermal treatment. The oil line was repaired in January 1993. The soil sample results from the 1993 and 2001 subsurface investigations are presented in Section 8.

During tank upgrading activities in 1998, petroleum-impacted soil was discovered, possibly stemming from overfill of either UST #4 or #5 (Anchor and HAI 2000). The potential release was reported to DEQ but no soil samples were collected (Anchor and HAI 2000).

8. CURRENT AND HISTORIC SOURCES AND COPCS

The understanding of the historic and current potential upland and overwater sources at the site is summarized in Table 1. The following sections provide a brief overview of the potential sources and COPCs at the site requiring additional discussion.

8.1. Uplands

The following potential and/or confirmed upland sources have been identified at the Brix facility (Anchor 2000):

- Former gasoline UST and pipelines
- Former lube oil UST and pipelines
- Existing lube oil UST and pipelines
- Existing diesel USTs and pipelines
- Former gasoline dispenser area
- Former 30-weight oil pipeline area
- Stormwater catchbasins
- Transformers.

8.2. Overwater Activities

☒ Yes ☐ No

As mentioned above, overwater activities at the Brix site include maintenance activities performed at a permanently moored, covered barge at the facility dock. The following overwater activities or features at the Brix facility have been identified as potential contaminant sources:

- Vessel servicing operations
- Vessel emissions (hydrocarbon exhaust) and/or discharges
- Maintenance Barge operations
- Dock structure (possible creosote-coated pilings).

8.3. Spills

Known or documented spills at the Foss Maritime Co./Brix Maritime Co. site were obtained either from DEQ's Emergency Response Information System (ERIS) database for the period of 1995 to

2004, from oil and chemical spills recorded from 1982 to 2003 by the U.S. Coast Guard and the National Response Center's centralized federal database [see Appendix E of the Portland Harbor Work Plan (Integral et al. 2004)], from facility-specific technical reports, or from DEQ correspondence. These spills are summarized below.

Date	Material(s) Released	Volume Spilled (gallons)	Spill Surface (gravel, asphalt, sewer)	Action Taken (yes/no)
1/18/1995	Not Specified	Unknown	Willamette River	Unknown; DEQ 145
3/9/1995	Power Steering Fluid	Unknown	Willamette River	Unknown; DEQ 486
4/14/1995	Lube Oil	Unknown	Willamette River	Unknown; DEQ 95
7/15/1995	Diesel Fuel	Unknown	Willamette River	Unknown
3/28/1996	Diesel Fuel	Unknown	Work deck and fueling dock	Unknown
5/7/1996	Not Specified	Unknown	Willamette River	Unknown
6/19/1996	Bilge Oil From Tug	Unknown	Willamette River	No
9/22/1997	Not Specified	Unknown	Willamette River	Unknown
5/31/1998	Diesel Fuel	25	Willamette River	Unknown
2/7/00	Not Specified	Unknown	Willamette River	yes

At least one incident is recorded (October 7, 1997) of a sheen observed emanating from a site outfall (not specified) to the Willamette (Anchor and HAI 2000).

9. PHYSICAL SITE SETTING

An understanding of the site's physical setting began with subsurface explorations in 1993 in response to a lube oil pipeline release and subsequent excavation [see Supplemental Figure 2 from Anchor and HAI (2000, Appendix K)]. Brix Marine conducted additional investigations during the 1998 UST decommission and upgrade, and the more recent investigations of the nature and extent of environmental contaminants at the site (approximately 2001 to 2004). Brix installed 13 soil borings in 1993, 17 Geoprobe borings in 2001, and 7 monitoring wells at the site between July 2002 and July 2003. The following information on the conceptual geology and hydrogeology site model is summarized from subsurface investigations reports and the RI Work Plan (Anchor 2003). Monitoring well locations are shown in Supplemental Figure 5 from Anchor (2003).

9.1. Geology

Results from the subsurface borings indicate that the general site stratigraphy from the ground surface downward consists of the following:

- Fine to medium sand (Recent Fill) - (shallow alluvial aquifer)
- Silt (Pleistocene and Recent Alluvium) - (aquitard).

The stratigraphy at the site is depicted in the cross section [see Supplemental Figure 6 from Anchor (2003)]. The steep hillsides of the Portland West Hills made of basalt are present just west of the site and St. Helens Road. The top of the silt aquitard is likely the former natural ground surface, which is covered by the fine to medium sand placed as dredge fill. The silt aquitard appears contiguous based on the current monitoring well network. The top of the aquitard unit is partially exposed at the base of the riverbank during periods of low river stage. Explorations penetrate only to the depth of the top of the silt aquitard unit.

Based on aerial photos, the historic bankline along the northern portion of the site appears to have been inland of the current site shoreline during the 1930s. In addition, before development, two small drainage channels appeared to cross through the southern and northern portions of the site from east to west [see Supplemental Figures 1936 and 1961 Aerial Photographs from Anchor (2000)]. A 48-inch stormwater pipe across the northern portion of the site generally follows one of these historic drainage channels.

The current subsurface information is limited to the central and southern two-thirds of the site, where releases are being investigated.

9.2. *Hydrogeology*

A thin shallow groundwater aquifer is present beneath the site in the sand or recent fill unit. The native silt unit is the aquitard or base of the shallow aquifer. Currently, seven monitoring wells and one river staff gauge are installed to monitor groundwater conditions in the shallow aquifer. The following is a summary of the shallow aquifer information obtained from the RI Work Plan (Anchor 2003).

Shallow Aquifer	
Number of Monitoring Wells	7 (and a river staff gauge)
Groundwater Flow Direction	Northeast toward the river
Horizontal Gradient	0.2 linear foot per foot between the upland and the river's edge 0.014 linear foot per foot on upland portion of site

Recharge to shallow groundwater at the site appears to occur primarily from precipitation, or run off from the hills to the west, which infiltrates upslope of the site (Anchor 2003). The shallow groundwater is interpreted to move along the top of the aquitard from the western edge of the site and discharges to the Willamette River [see Supplemental Figure 6 from Anchor (2003)]. The shallow aquifer is sensitive to seasonal recharge conditions, with one well installed to the base of the sand unit drying up during the dry season.

Seep Locations. No groundwater seeps were identified during the Portland Harbor RI/FS seep reconnaissance survey (GSI 2003). Groundwater has been observed occasionally discharging along the sand-silt interface during low river levels (estimated elevation of 8 feet MSL) during monthly shoreline reconnaissance implemented by Brix (Anchor 2003).

10. NATURE AND EXTENT *(Current Understanding)*

The current understanding of the nature and extent of contamination for the uplands portions of the site is summarized in this section. When no data exist for a specific medium, a notation is made.

10.1. *Soil*

10.1.1. Upland Soil Investigations ☒ Yes ☐ No

Following the initial excavation of contaminated soil from the lubrication oil transfer lines release in January 1993, a test pit was excavated to a depth of 12 feet below ground surface (bgs) in an attempt to determine the vertical extent of contamination (HAI 1993). Soil samples contained diesel and oil concentrations ranging from <50 up to 53,400 mg/kg. Gasoline was not detected above the 20-mg/kg detection limit (HAI 1993). Although contamination was observed at the bottom of the test pit, the excavation was halted at 12 feet bgs due to the instability of the native soils and the proximity of the maintenance building (HAI 1993). Tank tests were conducted on the diesel tanks onsite following the test pit excavation and the tanks and their associated piping were found to be within tolerance (HAI 1993).

On April 15 and 16, 1993, 13 soil borings were conducted in and around the tank farm and

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dispensing system [B-1 through B-13; see Supplemental Figure 5 of Anchor and HAI (2001)]. Soil borings ranged from 5 to 26.5 feet bgs (HAI 1993). Eighteen soil samples were analyzed for parameters including hydrocarbon identification (HCID), gasoline, and/or oil (HAI 1993). Gasoline-range hydrocarbons in subsurface soil ranged from undetected (at a 20-mg/kg detection limit) up to 2,000 mg/kg; oil concentrations ranged from undetected (at a 50 mg/kg detection limit) up to 200 mg/kg (HAI 1993). Diesel was not detected above the 50 mg/kg detection limit (HAI 1993). No remedial action was taken at the time (Anchor and HAI 2000).

Subsequent to DEQ's strategy recommendation in 1999 and requests for additional information about the site, a PA and further subsurface sampling were conducted to assess the extent of subsurface soil and groundwater contamination (Anchor and HAI 2001). Soil sampling performed in May 2001 included 17 push-probe borings [B-14 through B-30; see Supplemental Figure 5 of Anchor and HAI (2001)]. Detected analyte results are summarized below (Anchor and HAI 2001):

Analyte	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Gasoline	<0.500	1,370
Diesel	<21.3	2,340
Oil	<53.2	22,200
Total Lead	3.03	4.4
Benzene	<0.050	5.2
Ethylbenzene	<0.00272	23.4
Xylenes	<0.005	134.9
Iso-propylbenzene	<0.005	2.58
1,2,4-Trimethylbenzene	<0.005	59.8
1,3,5-Trimethylbenzene	<0.005	18.7

The subsurface soil analytical results indicated two areas of petroleum hydrocarbon contamination: gasoline and gasoline constituent contamination in a limited area in the vicinity of the former gasoline dispenser, and primarily diesel and oil contamination in the area of the former oil pipeline. Subsurface impacts are generally limited to the sand fill unit that lies above a native silty clay unit at the site. Gasoline and/or oil concentrations were detected in borings within approximately 5 feet of the riverbank [see Supplemental Figure 2; Anchor and HAI (2001)].

Following submittal of the PA/XPA in 2001, DEQ requested Brix to perform an RI to fully define the nature and extent of releases of hazardous substances to the upland portion of the site, to determine whether source control measures are necessary, and to evaluate the potential impacts of the site to the Willamette River (DEQ 2001, pers. comm.). Brix submitted a Pre-RI Work Plan in May 2002 that called for a groundwater investigation at the site. Between July 2002 and June 2003, seven monitoring wells were installed onsite. The results of the groundwater monitoring from these wells is discussed in Section 9.2 below. Soil samples collected during the monitoring well installation were submitted for VOC, TPH, PAHs, and total lead analyses. The analytical results for these soil samples are included in Table 2 of Anchor (2003) (attached). Detected constituents in the monitoring well borings are summarized below:

Analyte	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Diesel	<27	360
Oil	<110	390
Total Lead	4	32.5
Ethylbenzene	<0.00071	2.5
Xyelenes	<0.0019	2.733
Naphthalene	<0.0011	64
Isopropylbenzene	<0.00084	7
n-Propylbenzene	<0.00089	18
1,2,4-Trimethylbenzene	<0.0011	59
Naphthalene	<0.0048	22
Acenaphthylene	<0.0048	0.039
Acenaphthene	<0.0048	0.052
Dibenzofuran	<0.0048	0.017
Fluorene	<0.0048	0.11
Phenanthrene	0.009	0.49
Anthracene	0.006	0.088
2-Methylnaphthalene	<0.0048	24
Fluoranthene	0.029	0.72
Pyrene	0.063	0.85
Benzo(a)anthracene	0.009	0.33
Chrysene	0.014	0.56
Benzo(b)fluoranthene	0.012	0.94
Benzo(k)fluoranthene	0.013	0.95
Benzo(a)pyrene	0.014	0.92
Indeno(1,2,3-cd)pyrene	0.021	2
Dibenzo(a,h)anthracene	<0.0048	0.15
Benzo(g,h,i)perylene	0.025	2.3

10.1.2. Riverbank Samples

☐ Yes ☒ No

10.1.3. Summary

An RI Work Plan was submitted to DEQ on November 26, 2003 (Anchor 2003; Bayuk 2004). The Work Plan focuses on the potential for the site to be a contaminant source the river. As such, it does not call for additional soil sampling or remediation. DEQ provided comments on the Work Plan to Brix on February 25, 2004, and is currently awaiting Brix's response (Bayuk 2004, pers. comm.). In their comments, DEQ noted that the following soil analytical data gaps relative to potential impacts to the river at the site exist:

- The occurrence, extent, and movement of subsurface "oil" observed in the sidewalls of the 1993 excavation are to be considered in the source control screening assessment.
- Soil samples selected for COC analysis from those collected at the margins of the excavation area in May 2001 did not meet the objective of evaluating "worst case" contamination in the source area of the release.

10.2. Groundwater

10.2.1. Groundwater Investigations ☒ Yes ☐ No

Groundwater investigations began at the site in May 2001 with the collection of grab groundwater samples from six Geoprobe borings to investigate potential petroleum hydrocarbon impacts [see Supplemental Figures 4 and 6 from Anchor and HAI (2001)]. Seven shallow monitoring wells were installed at the facility between July 2002 and July 2003 to assess and monitor petroleum impacts to the shallow groundwater beneath the site and evaluate temporal contaminant trends [see Supplemental Figure 5 from Anchor (2003)]. The most recently reviewed groundwater data set is from the October 2003 sampling event presented in the RI Work Plan (Anchor 2003).

10.2.2. NAPL (Historic & Current) ☒ Yes ☐ No

Petroleum hydrocarbon NAPL has been observed in monitoring well MW-3 during the dry season, late summer, and fall; it has not been observed in monthly measurements since December 2003 (Dana Bayuk, pers. comm., September 2, 2004). MW-3 is installed at the location of the lube oil release and the associated highest TPH-soil concentrations. NAPL thicknesses range from not observed to 0.19 foot thick. NAPL monitoring in the monitoring wells and along the shoreline is ongoing at the site.

10.2.3. Dissolved Contaminant Plumes ☒ Yes ☐ No

A petroleum hydrocarbon plume is present in the shallow aquifer beneath the site. The plume consists of gasoline and heavier-range petroleum hydrocarbon constituents. The only metal analyzed in groundwater is lead. Dissolved lead concentrations in groundwater are generally less than 0.5 part per billion (ppb).

Plume Characterization Status ☐ Complete ☒ Incomplete

Based upon review of the available data, the current monitoring well system appears to have the approximate lateral extent of the plume defined. However, DEQ has not made a conclusion.

Plume Extent

Based upon the data reviewed by GSI, the extent of the petroleum hydrocarbon groundwater plume is shown in Figure 2. The plume is present in the middle and southern portions of the site extending from the former gasoline/fuel dispenser in the west to the river in the east. The sources for the groundwater plume appear to be the locations of the former gasoline/fuel dispenser and the historic lube oil release in 1993 [see Supplemental Figure 2 from Anchor and HAI (2000)].

Min/Max Detections (Current situation)

The October 2003 minimum and maximum petroleum-hydrocarbon-related detections at the site include the following:

Analyte	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)
Total Petroleum Hydrocarbons (TPH)		
TPH-Gasoline	<50	8,100
TPH-Diesel	<250	3,400
TPH- Dx (Heavy oils)	<500	8,500
Volatile Organic Compounds (VOCs)		
Benzene	<0.5	32
Toluene	<0.5	14
Ethylbenzene	<0.5	270
Total Xylenes	<0.5	470
Naphthalene	<1	460
1,2,4-TMB	<2	1200
1,3,5-TMB	<2	280
n-Propylbenzene	<2	250
n-Butylbenzene	<2	150
Polycyclic Aromatic Hydrocarbons (PAHs)		
LPAH	--	203
HPAH	--	34.97

µg/L = micrograms per liter
TMB = trimethylbenzene
* = detection limit per individual PAH

Current Plume Data

Based upon the data reviewed by GSI, the current estimated extent of the petroleum plume in the shallow aquifer is shown in Figure 2. The plume shown on Figure 2 is based on detections. The wells located at the north (MW-2) and south (MW-7) edges had very low detections of petroleum hydrocarbon constiturents.

Preferential Pathways

The historic drainage channel cutting across the southern portion of the site potentially may be a natural preferential groundwater flow pathway [see Supplemental Figures 1936 and 1961 Aerial Photographs from Anchor (2000)]. Monitoring wells MW-4, MW-5, and MW-7 monitor the groundwater conditions near this historic feature.

Several stormwater outfalls and utilities are cutting across the property. However, no information has been presented regarding the depths of the utilities at the facility relative to the shallow groundwater table or if the utility and associated backfill may be a preferential pathway at the site.

Downgradient Plume Monitoring Points (min/max detections)

Monitoring well MW-4 was considered the downgradient monitoring point. The minimum and maximum groundwater results from monitoring well MW-4 (four sampling events July 2002 – October 2003) include the following:

MW-4 Analyte	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)
Total Petroleum Hydrocarbons (TPH)		
TPH-Gasoline	<50	650
TPH-Diesel	<250	nd
TPH- Dx (Heavy oils)	<500	520
Volatile Organic Compounds (VOCs)		
Benzene	<0.5	0.76 (Feb 03 only)
Toluene	<0.5	nd
Ethylbenzene	<0.5	2.3 (Feb 03 only)
Total Xylenes	<0.5	2.6
Naphthalene	<1	45 (Feb 03 only)
1,2,4-TMB	<2	3.8 (Feb 03 only)
1,3,5-TMB	<2	2.2 (Feb 03 only)
n-Propylbenzene	<2	35
n-Butylbenzene	<2	3.1 (Feb 03 only)
Polycyclic Aromatic Hydrocarbons (PAHs)		
LPAH	--	19.4
HPAH	--	0.08

µg/L = micrograms per liter
nd = non-detect
TMB = trimethylbenzene
* = detection limit per individual PAH

Visual Seep Sample Data

☐ Yes ☒ No

Seep sample data are not available.

Nearshore Porewater Data

No nearshore porewater data were available in the site's investigation reports.

Groundwater Plume Temporal Trend

Groundwater analytical data have been collected quarterly from the monitoring wells for only 1.5 years. Temporal groundwater plume trends identified from this limited data set include the following:

- NAPL thicknesses increase during the dry season (late summer/early fall) in monitoring well MW-3 and have not been observed since December 2003.
- The shallow aquifer saturated thickness is sensitive to the precipitation/infiltration seasons, as demonstrated by some wells going dry during the dry season.

10.2.4. Summary

A dissolved groundwater plume consisting of petroleum hydrocarbon constituents is present beneath the central and southern portions of the site (see Figure 2). Groundwater flows from west to east across the site and ultimately discharges from the shallow aquifer to the river at the interface of the sand-silt aquitard unit. A historic natural drainage feature in the southern half of the site may locally influence shallow groundwater flow directions in this part of the site. No information has been presented regarding the depths of the utilities at the facility relative to the shallow groundwater table and other potential preferential groundwater pathways at the site.

NAPL has present in monitoring well MW-3 prior to December 2003. The well is located at the site of an historic lube oil pipeline release.

10.3. Surface Water

10.3.1.	**Surface Water Investigation**	☐ Yes	☒ No
10.3.2.	**General or Individual Stormwater Permit (Current or Past)**	☐ Yes	☒ No
	Do other non-stormwater wastes discharge to the system?	☐ Yes	☒ No
10.3.3.	**Stormwater Data**	☐ Yes	☒ No
10.3.4.	**Catch Basin Solids Data**	☐ Yes	☒ No
10.3.5.	**Wastewater Permit**	☐ Yes	☒ No
10.3.6.	**Wastewater Data**	☐ Yes	☒ No

10.3.7. Summary

The City of Portland has mapped five private stormwater outfall at the site (Figure 1). Site reports reviewed for this summary note that stormwater drains to five catch basins located in parking areas in the southern and western portions of the site. Anchor (2003) reports that these catch basins discharge to the Willamette River through two 4-inch outfalls. The general drainages are shown in Supplemental Figure 5 from Anchor (2003). However, the outfall locations are not shown and numbers are not provided, so it is not known which of the five outfalls shown in Figure 1 correspond to the two outfalls associated with the Brix site.

A 48-inch stormwater outfall is located at the northern corner of the Brix property (WR-212, Figure 1), which receives runoff from Forest Park streams and a small potion of NW St. Helens Road (City of Portland, pers. comm. September 2, 2004). However, while this outfall may not drain the Brix site, City records do not report any City-owned outfall at this location.

As noted in Section 5, storm water outfall 22D (WR 210, Figure 1) formerly existed on the property. The piping for the outfall historically ran under the main office building. Due to the collapse of the pipe, the City requested an easement and installed a new connection and outfall pipe (WR 212, Figure 1) on the northwest boundary of the Foss property in the summer of 1999. The old connection was plugged, and the former outfall was abandoned in place (Anchor and HAI 2000).

As noted in Section 8.3, at least one incident is recorded of a sheen emanating from a site outfall to the Willamette, but the outfall is not specified. No spills to the site catch basins have been recorded (Anchor and HAI 2000).

10.4. Sediment

10.4.1.	**River Sediment Data**	☒ Yes	☐ No

Two surface (0 to 10 cm) sediment samples have been collected from the Willamette River at the Brix facility (Figure 1). These samples were collected in 1997 during the Battelle (2002) survey conducted for the Light Products Survey Group. The samples were analyzed for SVOCs, pesticides, and grain-size distribution; the detected analytical results

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are summarized in Table 2. Numerous PAHs and other SVOCs were detected (Table 2). Low molecular weight PAHs (LPAHs) were detected at 478 μg/kg (LPSG-S-020-R-1) and 3,462 μg/kg (LPSG-S-18-R1), and high molecular weight PAHs (HPAHs) were detected at 2,644 μg/kg (LPSG-S-18-R1) and 19,408 μg/kg (LPSG-S-020-R-1). One pesticide compound, diphenyl, was detected at 5 μg/kg (LPSG-S-020-R-1) and 21 μg/kg (LPSG-S-18-R1).

10.4.2. Summary

See Final CSM Update.

11. CLEANUP HISTORY AND SOURCE CONTROL MEASURES

11.1. Soil Cleanup/Source Control

As noted above, approximately 45 cubic yards of petroleum-contaminated soil was excavated and removed from the site in 1993 following the detection of contamination in subsurface soil (Anchor and HAI 2000). In 1998, two of the original five USTs were removed, and the spill protection systems of remaining three were updated. Subsurface soil and groundwater sampling identified two areas of petroleum-contaminated soil that have yet to be remediated.

Brix signed a Voluntary Agreement for an RI and Source Control Measures on May 8, 2002 (Anchor 2002c, pers. comm.). DEQ approved the Pre-RI Assessment and groundwater investigation work plans on July 12, 2002 (DEQ 2002b, pers. comm.).

11.2. Groundwater Cleanup/Source Control

Available records indicate that no groundwater cleanup or source control activities have been conducted at the site.

11.3. Other

Site stormwater catch basins in the vicinity of the drum storage area are equipped with sorbent pads that are periodically inspected and replaced as needed (Anchor and HAI 2000).

11.4. Potential for Recontamination from Upland Sources

See Final CSM Update

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Figures:

Tables:

Supplemental Figures:

Supplemental Tables:

FIGURES

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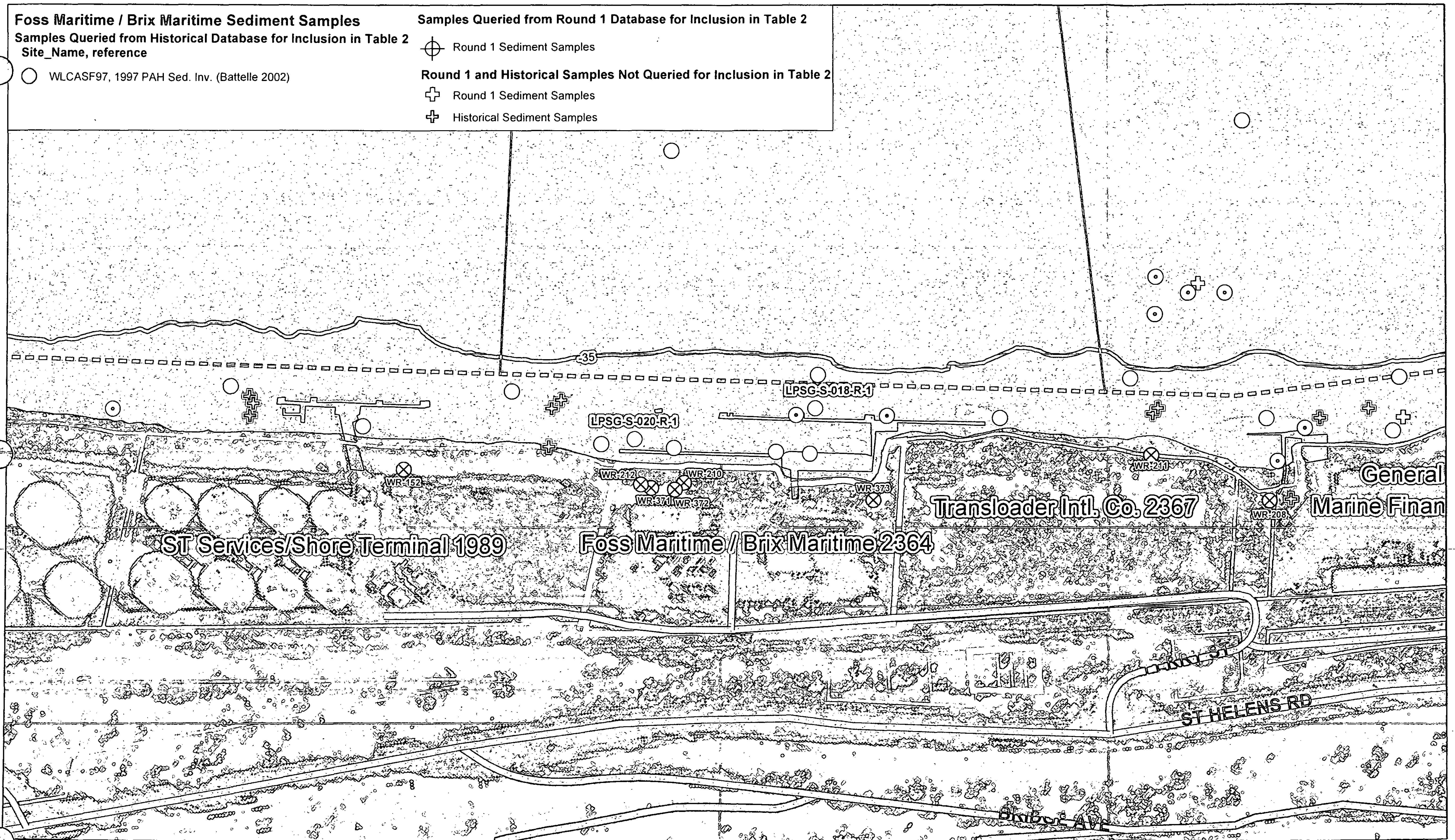

integral

LWG Lower Willamette Group

Map Document: (C:\GIS\Projects\Portland_Harbor\LWG-Map-Projects\Conseptual_Site_Model\Sample_Locations.mxd)
Plot Date: 08/19/2004

Areal Photo Date: October 2001.
Base Map features from Portland Metro's RLIS.

The City of Portland Outfall mapping information is based on available records; no warranty, expressed or implied, is provided as to the completeness or accuracy of the information. Current layer updated June 2004.

- Outfalls (private)
- City Outfalls
- City Outfalls (Abandoned)
- Seep Photo Location (Not location of actual Seep)

- River Miles
- Navigation Channel
- -35ft. Contour (NAVD 88)
- Docks & In-water Structures
- Selected ECSI Site Property Boundary

Human Use Areas
- Dockside Worker
- Recreational Beach Use
- Transient

LWG Round 2 Proposed Sediment Samples
- Surface Sample Only
- Core & Surface Sample

DRAFT

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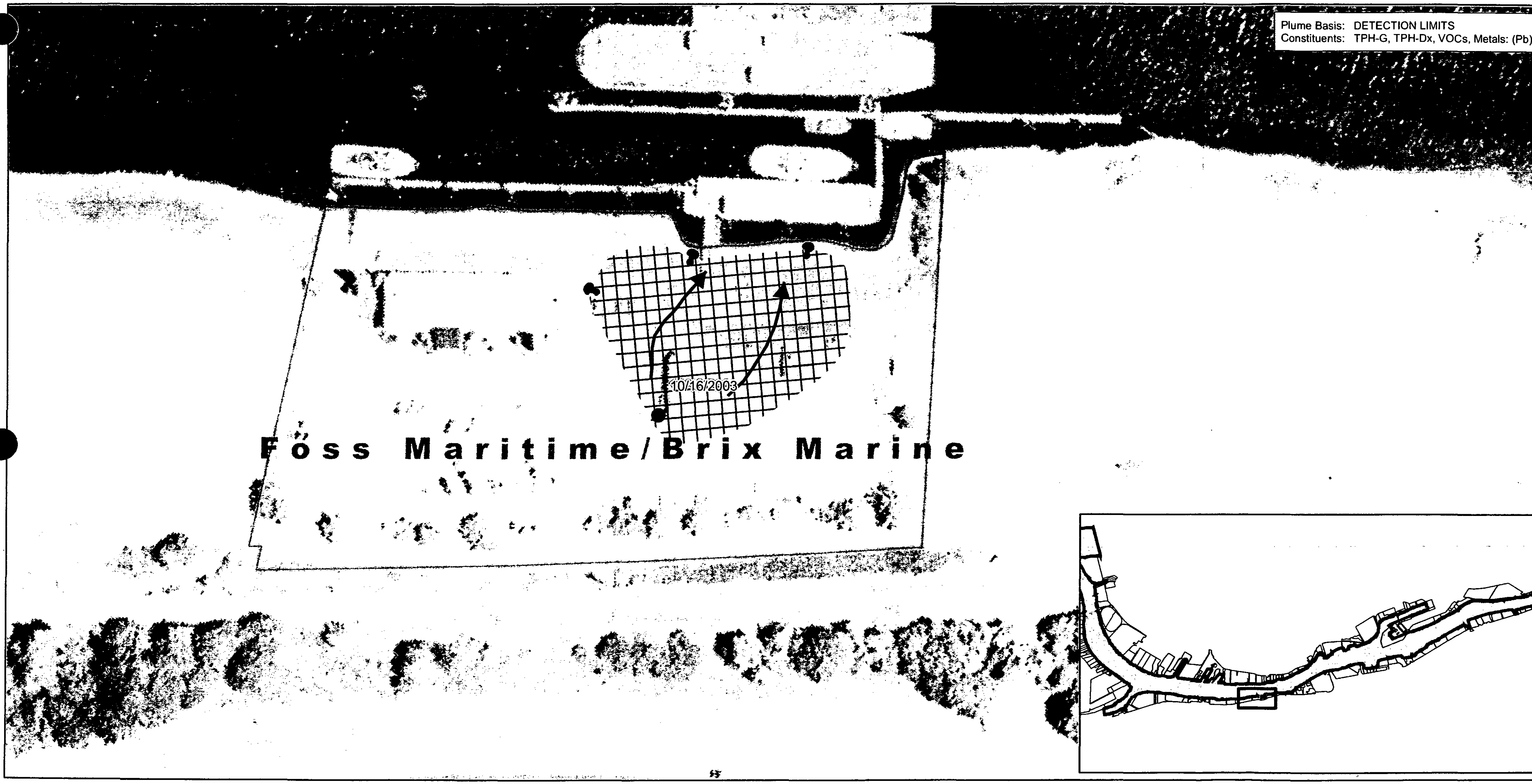
0 150 300 600 Feet

Figure 1
Portland Harbor RI/FS
Conceptual Site Model
Foss Maritime/
Brix Maritme
ECSI 398

DRAFT



Groundwater Solutions Inc.

LWG LOWER WILLAMETTE GROUP

0 75 150 Feet

FEATURE SOURCES:
Transportation, Water, Property, Zoning or Boundaries: Metro RLIS.
ECSI site locations were summarized in December, 2002 and January, 2003 from ODEQ ECSI files.

Map Creation Date: August 11, 2004

File Name: Fig2_FossMaritime_SummaryMap.mxd

LEGEND

Site Boundary

Maximum Detection Location

General Groundwater Flow

Contaminant Type

Petroleum related

Extent of Impacted Groundwater

For details, refer to plume interpretation table in CSM document.

Single or isolated detection of COI's. Extent or continuity of impacted groundwater between sample points is uncertain. Color based on contaminant type.

Estimated extent of impacted groundwater area. Color based on contaminant type.

Figure 2
Portland Harbor RI/FS
Foss Maritime/Brix Marine
Upland Groundwater Quality Overview

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TABLES

Foss Maritime Company/Brix Maritime Company
Table 1. Potential Sources and Transport Pathways Assessment

Last Updated: September 17, 2004

	Media Impacted					COIs														Potential Complete Pathway				
						TPH			VOCs															
Description of Potential Source	Surface Soil	Subsurface Soil	Groundwater	Catch Basin Solids	River Sediment	Gasoline-Range	Diesel - Range	Heavier - Range	Petroleum-Related (e.g. BTEX)	VOCs	Chlorinated VOCs	SVOCs	PAHs	Phthalates	Phenolics	Metals	PCBs	Herbicides and Pesticides	Dioxins/Furans	Butyltins	Overland Transport	Groundwater	Direct Discharge - Overwater	Direct Discharge - Storm/Wastewater	Riverbank Erosion
Upland Areas																									
A																									
Former gasoline UST and pipelines		✓	✓		?	✓			✓							✓						✓			
Former lube oil UST and pipelines		✓	✓		?			✓					✓									✓			
Existing lube oil UST and pipelines		✓			?			✓					✓									?			
Existing diesel USTs and pipelines		✓			?		✓															?			
Former gasoline dispenser area		✓	✓		?	✓	✓	✓								✓					?	✓			
Former 30-weight oil pipeline area		✓	✓		?	✓	✓	✓					✓								?	✓		?	
Catchbasins				?	?	✓	✓	✓				✓	✓			✓	?				?			?	
Transformers	?	?		?	?			✓									✓				?			?	
Overwater Areas																									
B																									
Vessel servicing operations					✓		✓	✓	✓							✓				✓			✓		
Vessel emissions and/or discharges							✓	✓	✓							✓							✓		
Maintenance Barge operations							✓	✓	✓	✓	✓	✓	✓			✓							✓		
Dock structure													✓			✓									
Other Areas/Other Issues																									

Notes:
[1] All information provided in this table is referenced in the site summaries. If information is not available or inconclusive, a ? may be used, as appropriate. No new information is provided in this table.
✓ = Source, COI are present or current or historic pathway is determined to be complete or potentially complete.
? = There is not enough information to determine if source or COI is present or if pathway is complete.
Blank = Source, COI and historic and current pathways have been investigated and shown to be not present or incomplete.

UST Underground storage tank
AST Above-ground storage tank
TPH Total petroleum hydrocarbons
VOCs Volatile organic compounds
SVOCs Semivolatile organic compounds
PAHs Polycyclic aromatic hydrocarbons
BTEX Benzene, toluene, ethylbenzene, and xylenes
PCBs Polychorinated biphenols

Table 2. Queried Sediment Chemistry Data

Chemical Name	Unit			
		Site Name	WLCASF97	WLCASF97
		Location ID	WLCASF97S018	WLCASF97S020
		Location Name	LPSG-S-018-R-1	LPSG-S-020-R-1
		Sample Date	06/12/1997	06/10/1997
		Sample ID	WLCASF97S018W4160	WLCASF97S020W4147
		Start Depth	0	0
		End Depth	10	10
		Surface or Subsurface		
Total organic carbon	%	surface	2.5	1.6
Gravel	%	surface	13.9	7.5
Sand	%	surface		
Very coarse sand	%	surface	3.3	6.3
Coarse sand	%	surface	18.1	27.7
Medium sand	%	surface	41.4	45.7
Fine sand	%	surface	12.5	6.9
Very fine sand	%	surface	3.3	2.3
Fines	%	surface		
Silt	%	surface		
Coarse silt	%	surface	1.4	.7
Medium silt	%	surface	1.9	.8
Fine silt	%	surface	1.4	.6
Very fine silt	%	surface	1.2	.6
Clay	%	surface		
8-9 Phi clay	%	surface	.6	.3
9-10 Phi clay	%	surface	.4	.3
>10 Phi clay	%	surface	.6	.3
Aluminum	mg/kg	surface		
Antimony	mg/kg	surface		
Arsenic	mg/kg	surface		
Cadmium	mg/kg	surface		
Chromium	mg/kg	surface		
Copper	mg/kg	surface		
Lead	mg/kg	surface		
Manganese	mg/kg	surface		
Mercury	mg/kg	surface		
Nickel	mg/kg	surface		
Selenium	mg/kg	surface		
Silver	mg/kg	surface		
Thallium	mg/kg	surface		
Zinc	mg/kg	surface		
Barium	mg/kg	surface		
Beryllium	mg/kg	surface		
Calcium	mg/kg	surface		
Cobalt	mg/kg	surface		
Iron	mg/kg	surface		
Magnesium	mg/kg	surface		
Potassium	mg/kg	surface		
Sodium	mg/kg	surface		
Vanadium	mg/kg	surface		
2-Methylnaphthalene	ug/kg	surface		
Acenaphthene	ug/kg	surface	135	59
Acenaphthylene	ug/kg	surface	260	22
Anthracene	ug/kg	surface	689	70
Fluorene	ug/kg	surface	127	38
Naphthalene	ug/kg	surface	97	29
Phenanthrene	ug/kg	surface	2154	260

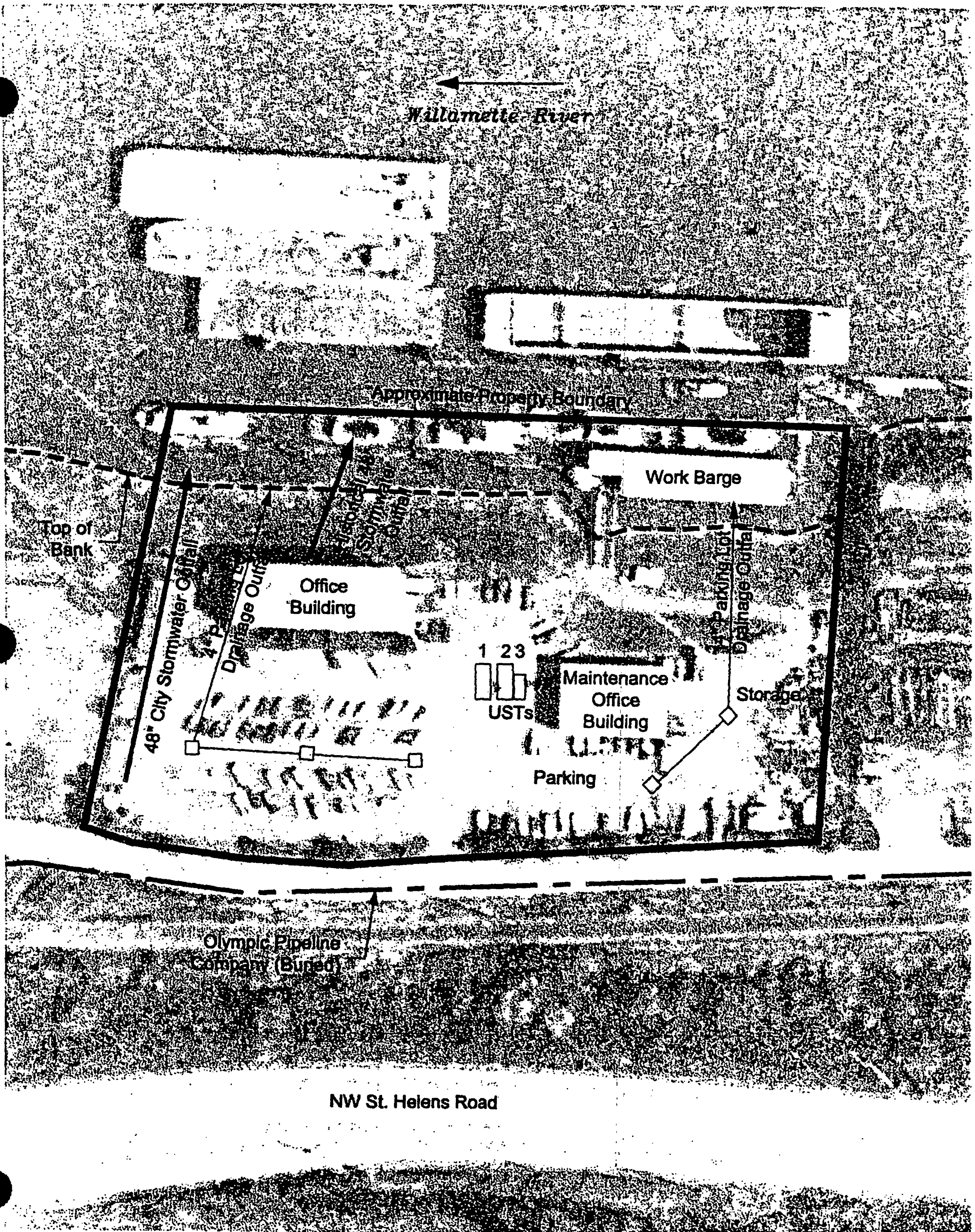
Table 2. Queried Sediment Chemistry Data

		Site Name	WLCASF97	WLCASF97
		Location ID	WLCASF97S018	WLCASF97S020
		Location Name	LPSG-S-018-R-1	LPSG-S-020-R-1
		Sample Date	06/12/1997	06/10/1997
		Sample ID	WLCASF97S018W4160	WLCASF97S020W4147
		Start Depth	0	0
		End Depth	10	10
Chemical Name	Unit	Surface or Subsurface		
Low Molecular Weight PAH	ug/kg	surface	3462 A	478 A
Dibenz(a,h)anthracene	ug/kg	surface	144	39
Benz(a)anthracene	ug/kg	surface	1267	204
Benzo(a)pyrene	ug/kg	surface	1976	306
Benzo(b)fluoranthene	ug/kg	surface	967	217
Benzo(g,h,i)perylene	ug/kg	surface	2076	253
Benzo(k)fluoranthene	ug/kg	surface		
Chrysene	ug/kg	surface	1486	237
Fluoranthene	ug/kg	surface	3782	437
Indeno(1,2,3-cd)pyrene	ug/kg	surface	1461	248
Pyrene	ug/kg	surface	5104	478
Benzo(b+k)fluoranthene	ug/kg	surface		
Benzo(j+k)fluoranthene	ug/kg	surface	1145	225
High Molecular Weight PAH	ug/kg	surface	19408 A	2644 A
Polycyclic Aromatic Hydrocarbons	ug/kg	surface	22870 A	3122 A
Benzo(e)pyrene	ug/kg	surface	1147	203
C1-Dibenzothiophene	ug/kg	surface	266	13
C1-Chrysene	ug/kg	surface	416	103
C1-Fluorene	ug/kg	surface	144	11
C1-Naphthalene	ug/kg	surface	36	12
C1-Fluoranthene/pyrene	ug/kg	surface	1387	172
C1-Phenanthrene/anthracene	ug/kg	surface	847	78
C2-Dibenzothiophene	ug/kg	surface	202	17
C2-Chrysene	ug/kg	surface	118	58
C2-Fluorene	ug/kg	surface	102	12
C2-Naphthalene	ug/kg	surface	94	16
C2-Fluoranthene/pyrene	ug/kg	surface	274	70
C2-Phenanthrene/anthracene	ug/kg	surface	426	68
C3-Dibenzothiophene	ug/kg	surface	114	17
C3-Chrysene	ug/kg	surface	50	39
C3-Fluorene	ug/kg	surface	100	17
C3-Naphthalene	ug/kg	surface	144	19
C3-Fluoranthene/pyrene	ug/kg	surface	99	47
C3-Phenanthrene/anthracene	ug/kg	surface	227	48
C4-Dibenzothiophene	ug/kg	surface	39	15
C4-Chrysene	ug/kg	surface	26	16
C4-Naphthalene	ug/kg	surface	96	14
C4-Phenanthrene/anthracene	ug/kg	surface	68	19
Total benzofluoranthenes (b+k (+j))	ug/kg	surface	2112	442
Diphenyl	ug/kg	surface	21	5
2,4,5-Trichlorophenol	ug/kg	surface		
2,4,6-Trichlorophenol	ug/kg	surface		
2,4-Dichlorophenol	ug/kg	surface		
2,4-Dimethylphenol	ug/kg	surface		
2-Chlorophenol	ug/kg	surface		
2-Methylphenol	ug/kg	surface		
2-Nitrophenol	ug/kg	surface		
4,6-Dinitro-2-methylphenol	ug/kg	surface		

Table 2. Queried Sediment Chemistry Data

Chemical Name	Unit			
		Site Name	WLCASF97	WLCASF97
		Location ID	WLCASF97S018	WLCASF97S020
		Location Name	LPSG-S-018-R-1	LPSG-S-020-R-1
		Sample Date	06/12/1997	06/10/1997
		Sample ID	WLCASF97S018W4160	WLCASF97S020W4147
		Start Depth	0	0
		End Depth	10	10
		Surface or Subsurface		
4-Chloro-3-methylphenol	ug/kg	surface		
4-Methylphenol	ug/kg	surface		
4-Nitrophenol	ug/kg	surface		
Pentachlorophenol	ug/kg	surface		
Phenol	ug/kg	surface		
Dimethyl phthalate	ug/kg	surface		
Diethyl phthalate	ug/kg	surface		
Dibutyl phthalate	ug/kg	surface		
Butylbenzyl phthalate	ug/kg	surface		
Di-n-octyl phthalate	ug/kg	surface		
Bis(2-ethylhexyl) phthalate	ug/kg	surface		
Bis(2-chloro-1-methylethyl) ether	ug/kg	surface		
2,4-Dinitrotoluene	ug/kg	surface		
2,6-Dinitrotoluene	ug/kg	surface		
2-Chloronaphthalene	ug/kg	surface		
2-Nitroaniline	ug/kg	surface		
3,3'-Dichlorobenzidine	ug/kg	surface		
3-Nitroaniline	ug/kg	surface		
4-Bromophenyl phenyl ether	ug/kg	surface		
4-Chloroaniline	ug/kg	surface		
4-Chlorophenyl phenyl ether	ug/kg	surface		
4-Nitroaniline	ug/kg	surface		
Benzoic acid	ug/kg	surface		
Benzyl alcohol	ug/kg	surface		
Bis(2-chloroethoxy) methane	ug/kg	surface		
Bis(2-chloroethyl) ether	ug/kg	surface		
Carbazole	ug/kg	surface		
Dibenzofuran	ug/kg	surface	25	18
Hexachlorobenzene	ug/kg	surface		
Hexachlorobutadiene	ug/kg	surface		
Hexachlorocyclopentadiene	ug/kg	surface		
Hexachloroethane	ug/kg	surface		
Isophorone	ug/kg	surface		
Nitrobenzene	ug/kg	surface		
N-Nitrosodipropylamine	ug/kg	surface		
N-Nitrosodiphenylamine	ug/kg	surface		
Dibenzothiophene	ug/kg	surface	247	25
Perylene	ug/kg	surface	565	116
1,2-Dichlorobenzene	ug/kg	surface		
1,3-Dichlorobenzene	ug/kg	surface		
1,4-Dichlorobenzene	ug/kg	surface		
1,2,4-Trichlorobenzene	ug/kg	surface		

SUPPLEMENTAL FIGURES



Source: Aerial photograph acquired from WAC, Corp. 1991.

ANCHOR ENVIRONMENTAL, L.L.C.

0 100
Scale in Feet

Figure 2
Site Map

10/04/00 BRX002c-01.dwg 99-056-01

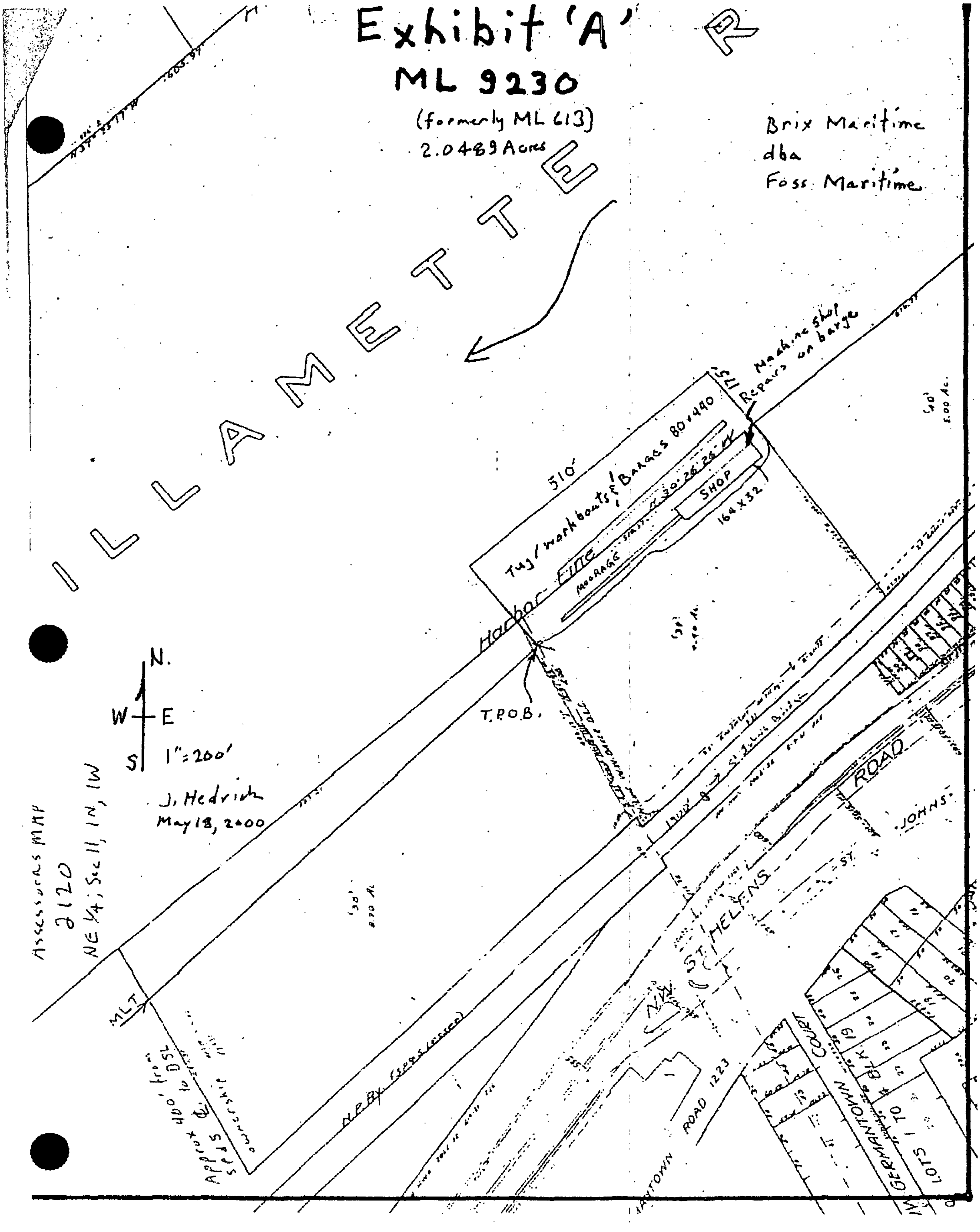
Exhibit 'A'

ML 9230

(formerly ML 613)

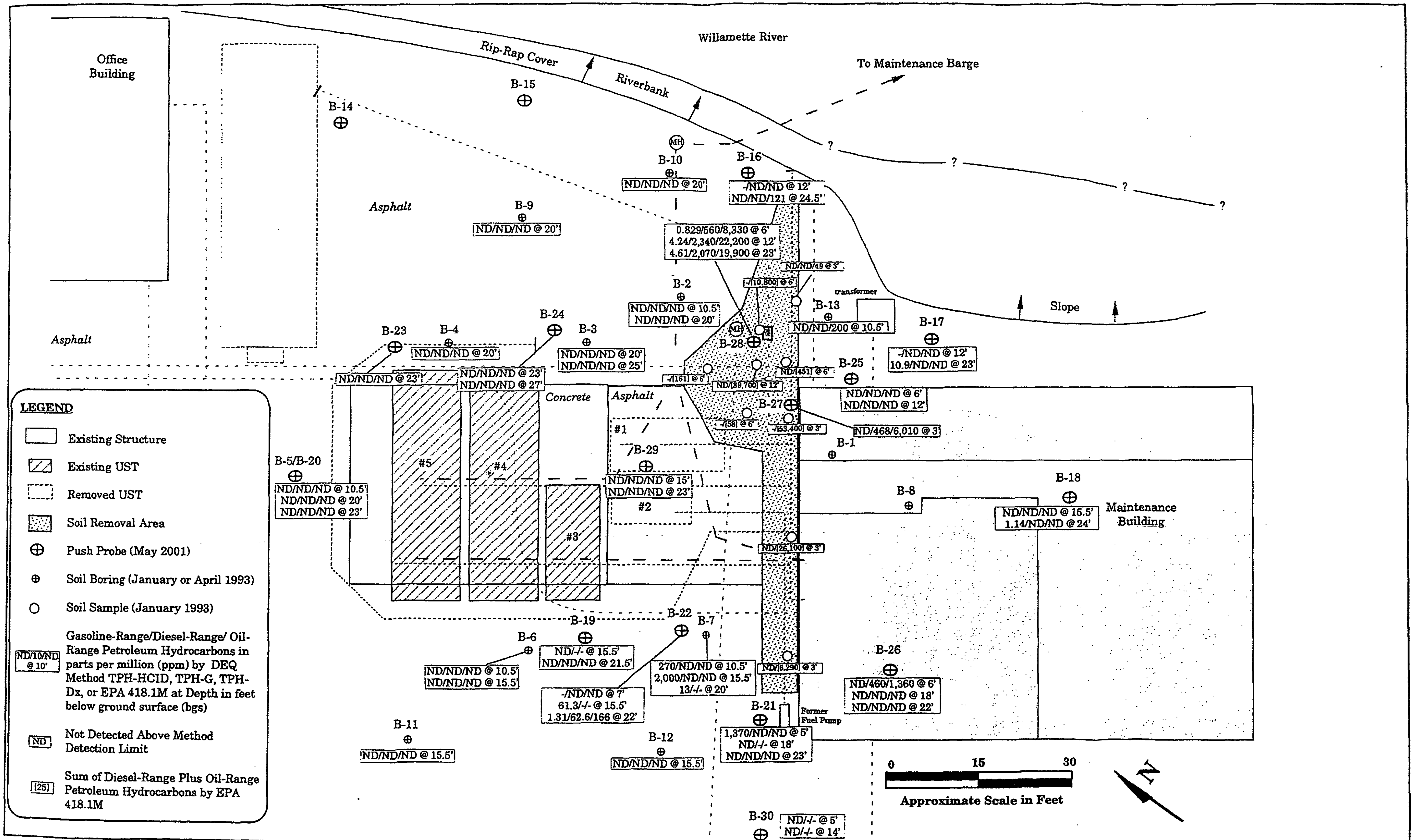
2.0489 Acres

Brix Maritime
dba
Foss Maritime



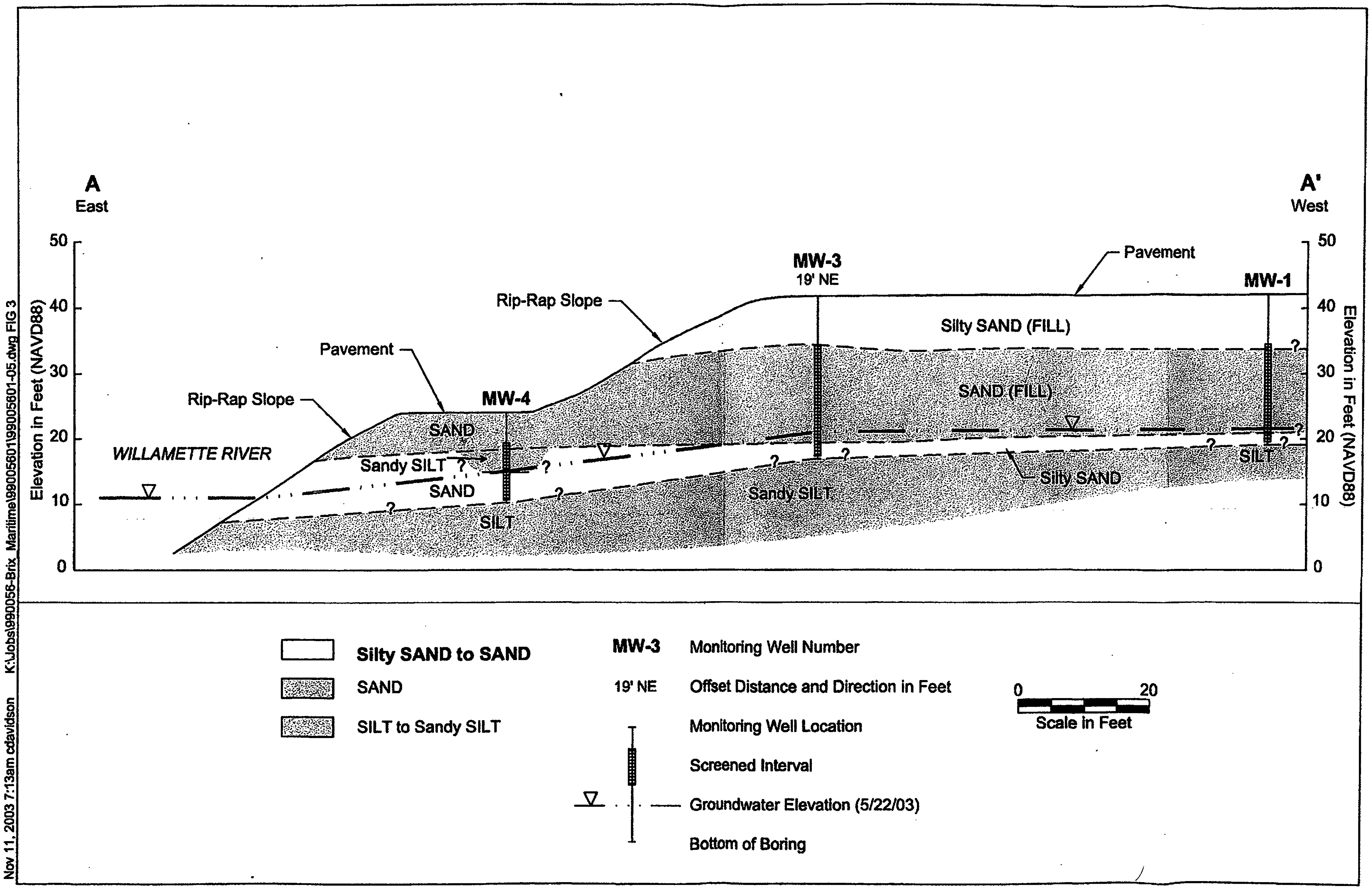
J. Hedrick
May 18, 2000

Assessors MAP
2120
NE 1/4, Sec 11, 1N, 1W



ANCHOR ENVIRONMENTAL, L.L.C.

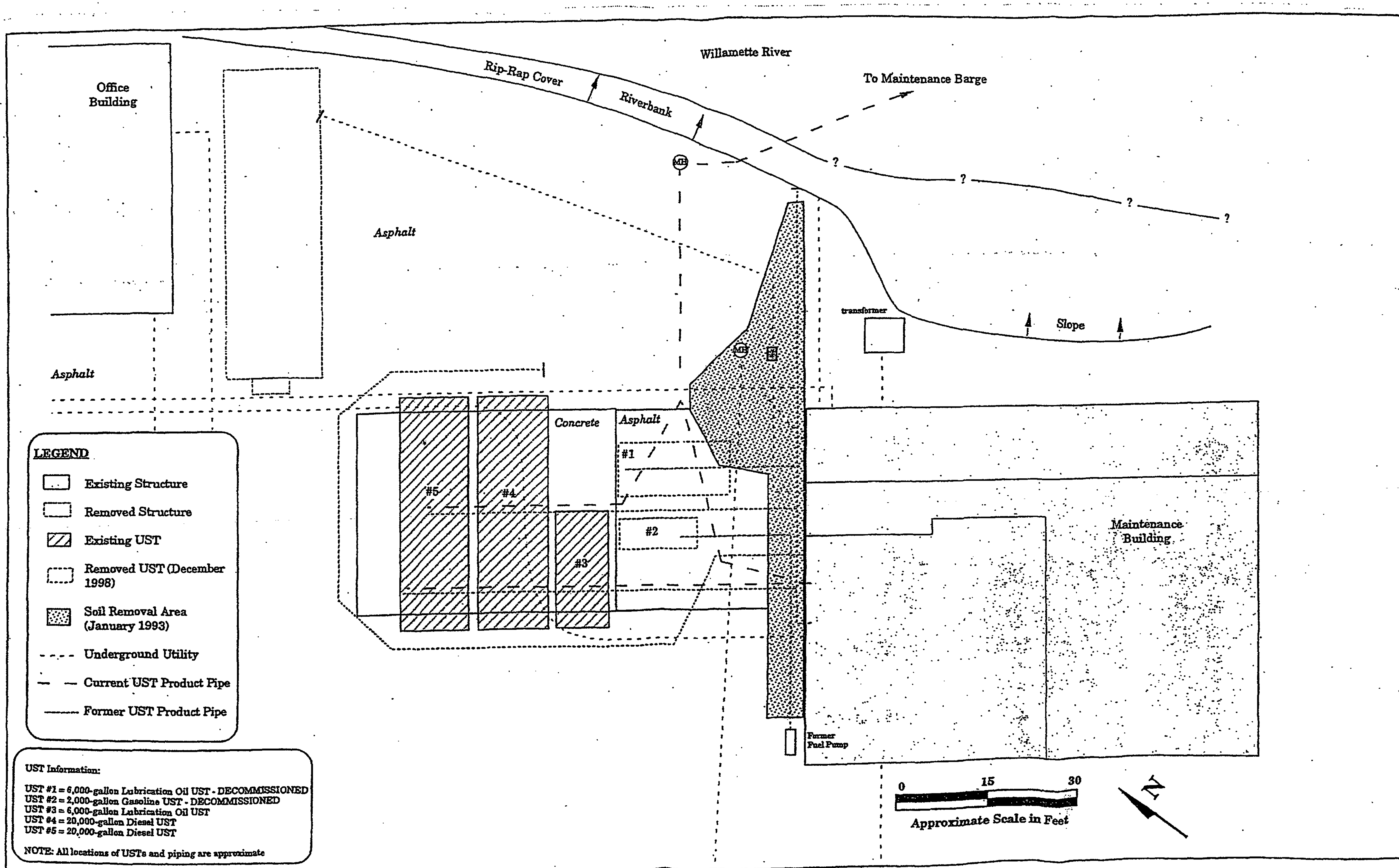
Figure 5
Petroleum Hydrocarbons in Soil



Nov 11, 2003 7:13am cdavidson K:\Jobs\990056-Brix Maritime\99005601\99005601-05.dwg FIG 3

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 6
Geologic Profile A-A'
Brix Maritime



ANCHOR ENVIRONMENTAL, L.L.C.

Figure 2
Underground Storage Tank Area Map

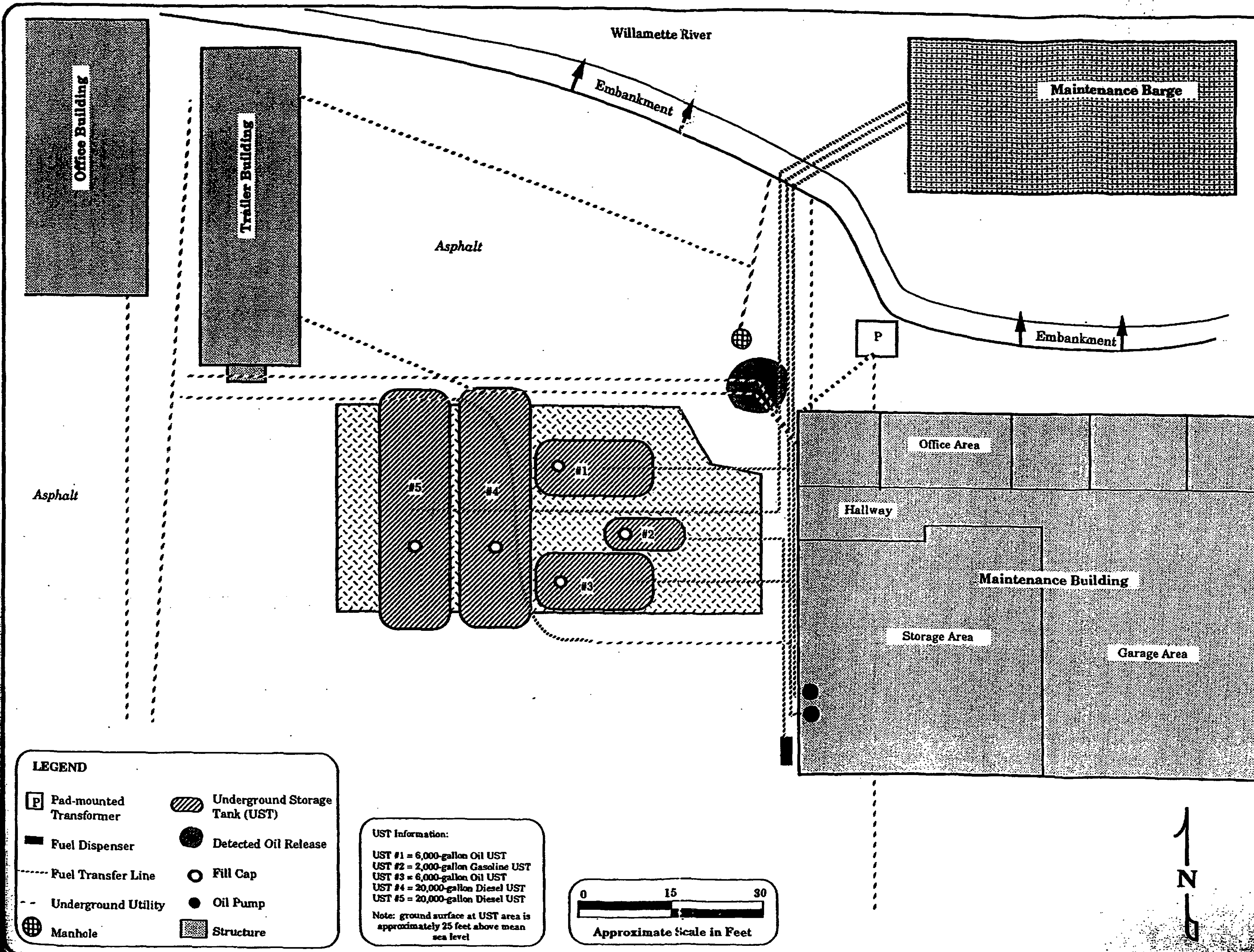


Figure 2

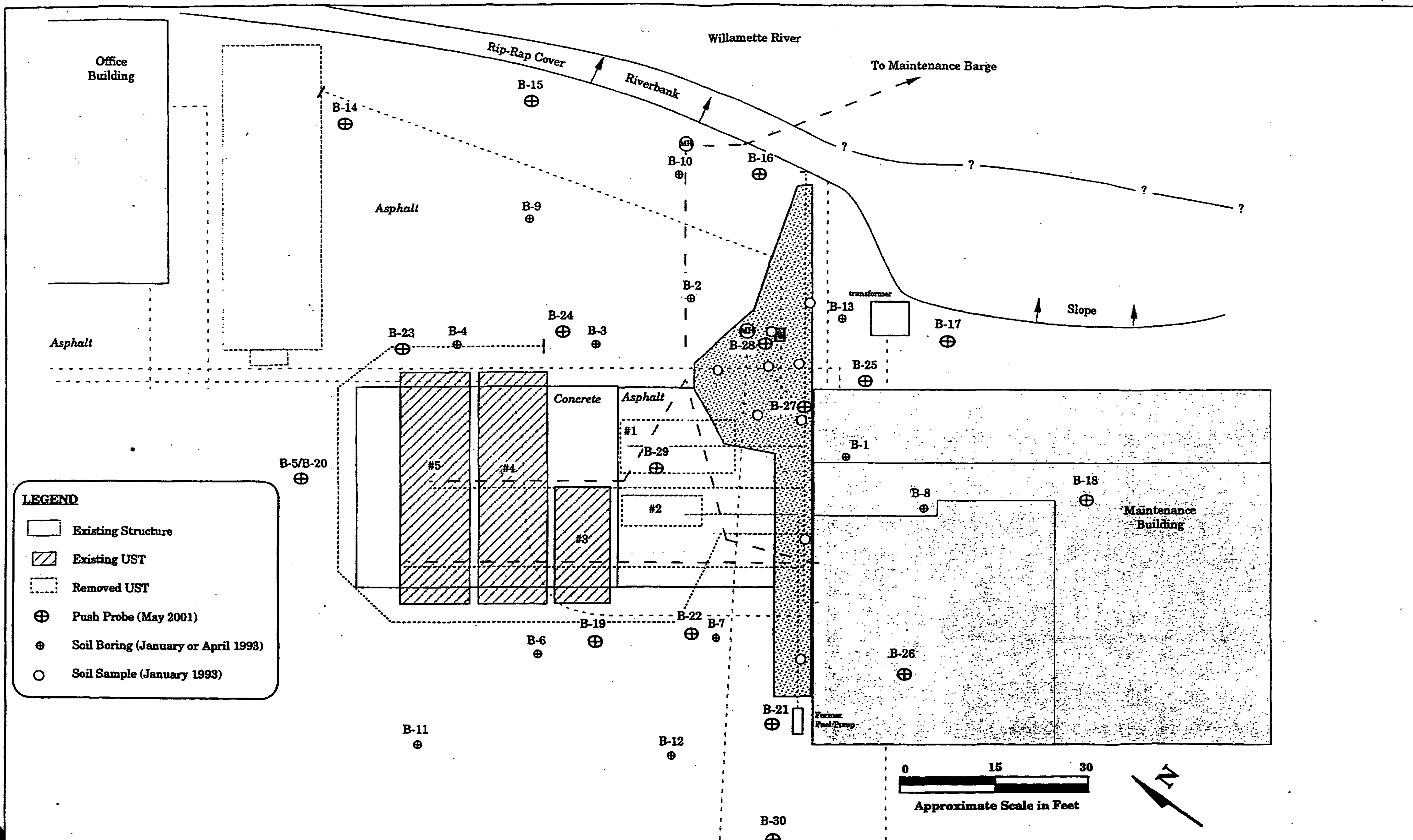
Facility Map

Subsurface Investigation
Brix Maritime Company
9030 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES
INCORPORATED
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

May 1993

Project 2289



ANCHOR ENVIRONMENTAL, L.L.C.

Figure 4
Sample Location Map

OMW-1 Monitoring Well Location and Number

(22.92) Groundwater Elevation in Feet (NAVD 88)

— 19.5 — Potentiometric Surface Contour in Feet

☐ Stormwater Catch Basin

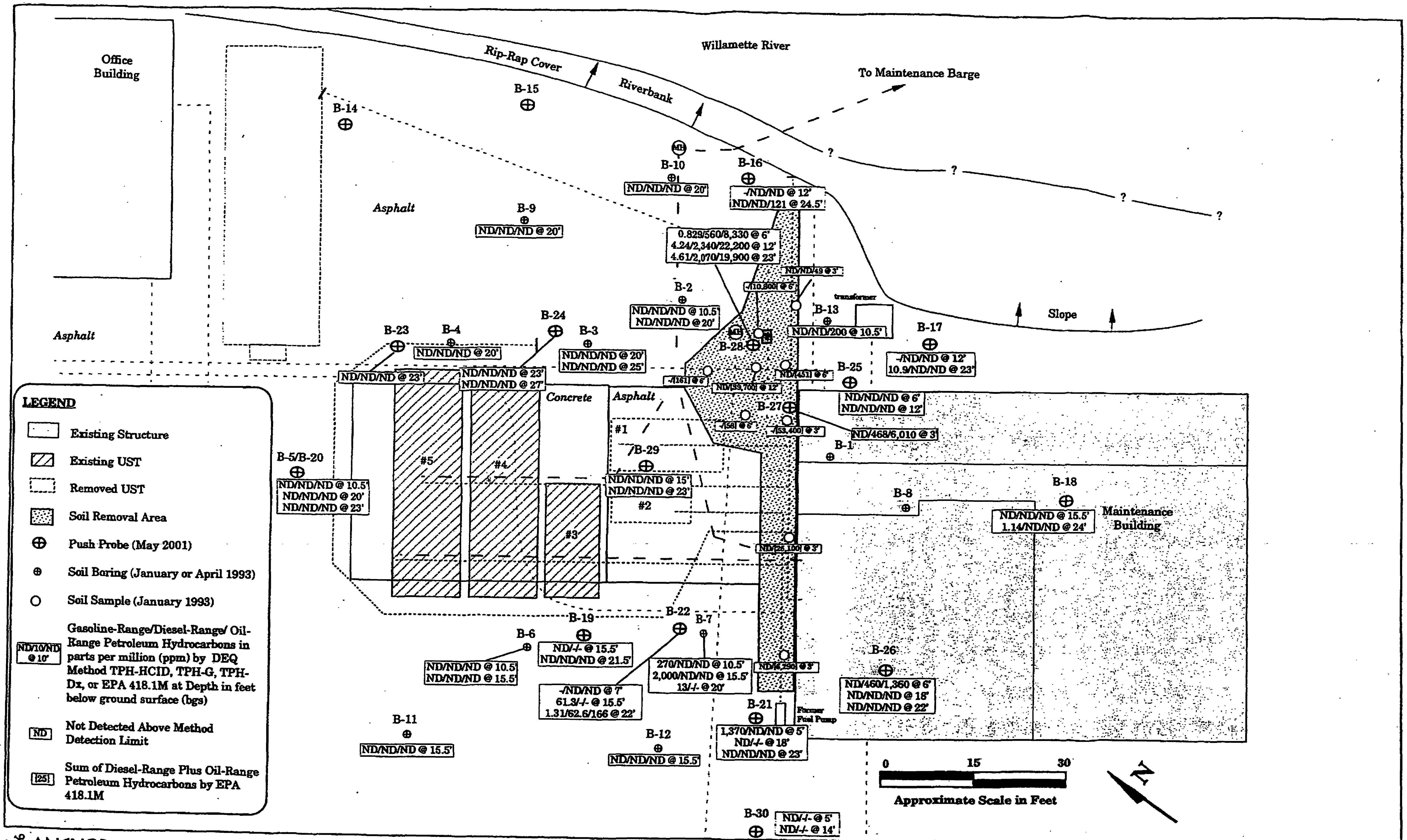
Geologic Profile Location and Designation

0 100 Scale in Feet

Source: Aerial photograph acquired from WAC, Corp. 1991.

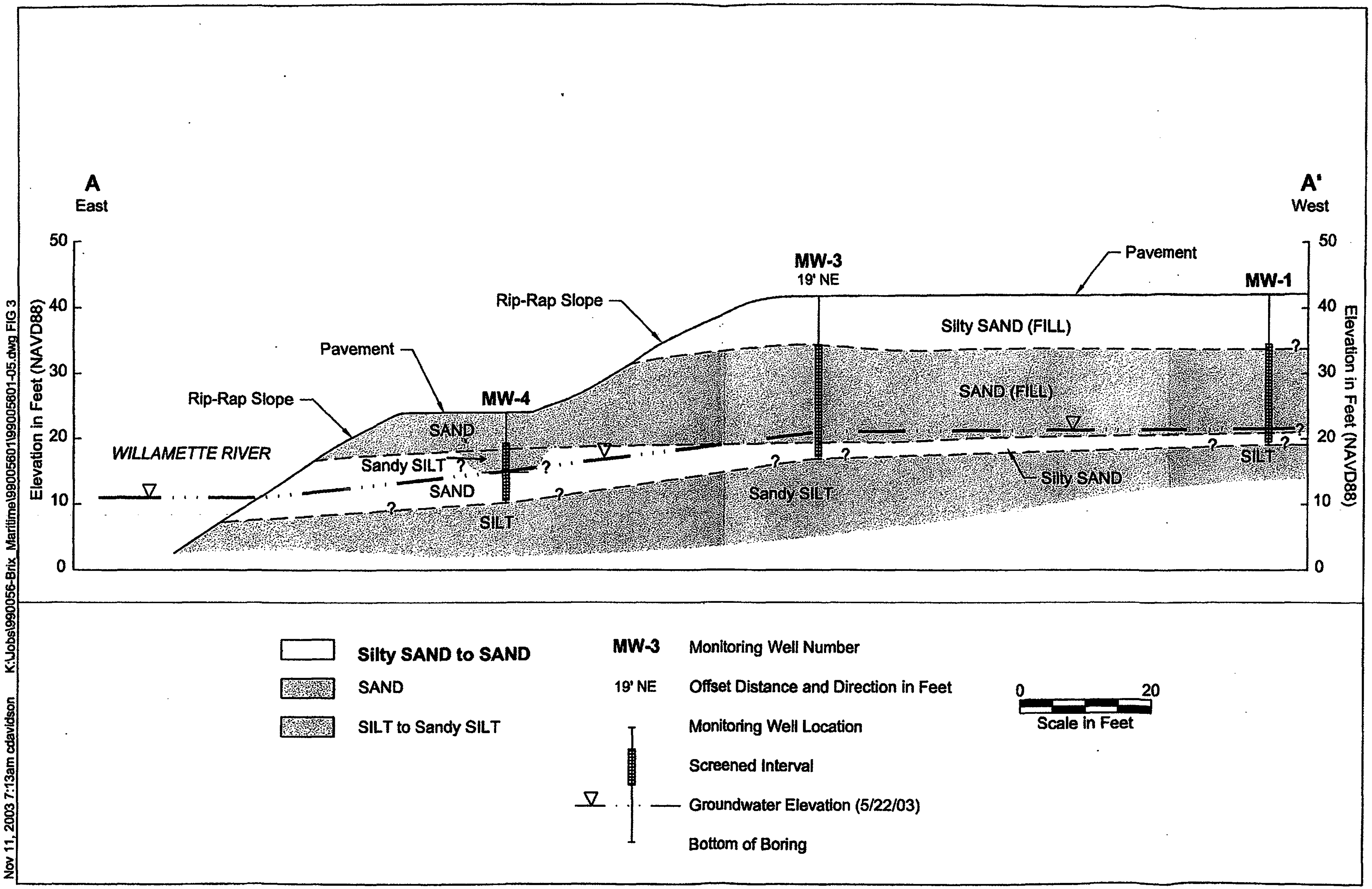
ANCHOR ENVIRONMENTAL, L.L.C.

Figure 5
Well Location and Potentiometric Surface Map (July 7, 2003)
Rdx Maritime



ANCHOR ENVIRONMENTAL, L.L.C.

Figure 5
Petroleum Hydrocarbons in Soil



Nov 11, 2003 7:13am cdavidson K:\Jobs\990056-Brix_Maritime\99005601\99005601-05.dwg FIG 3

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 6
Geologic Profile A-A'
Brix Maritime

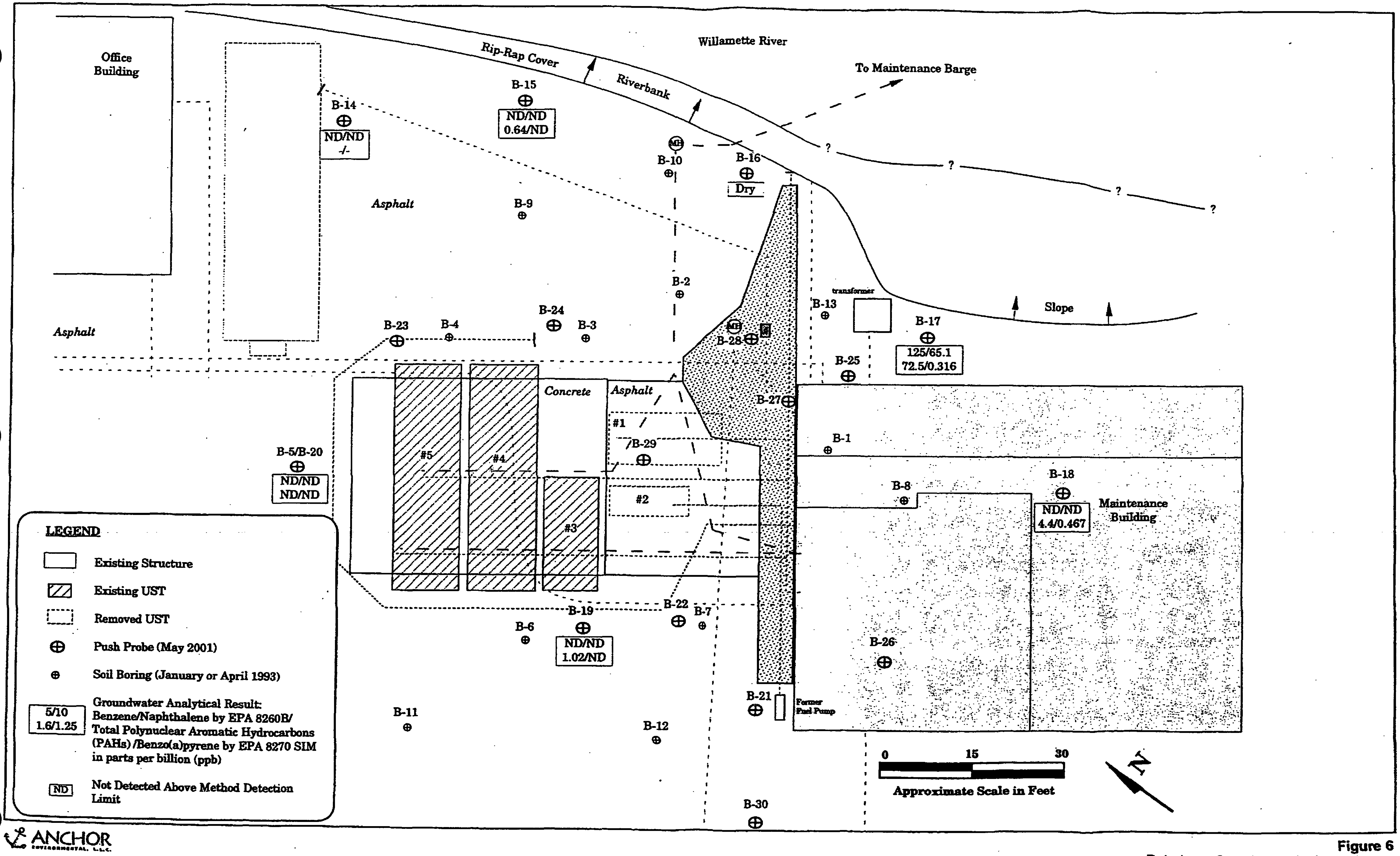
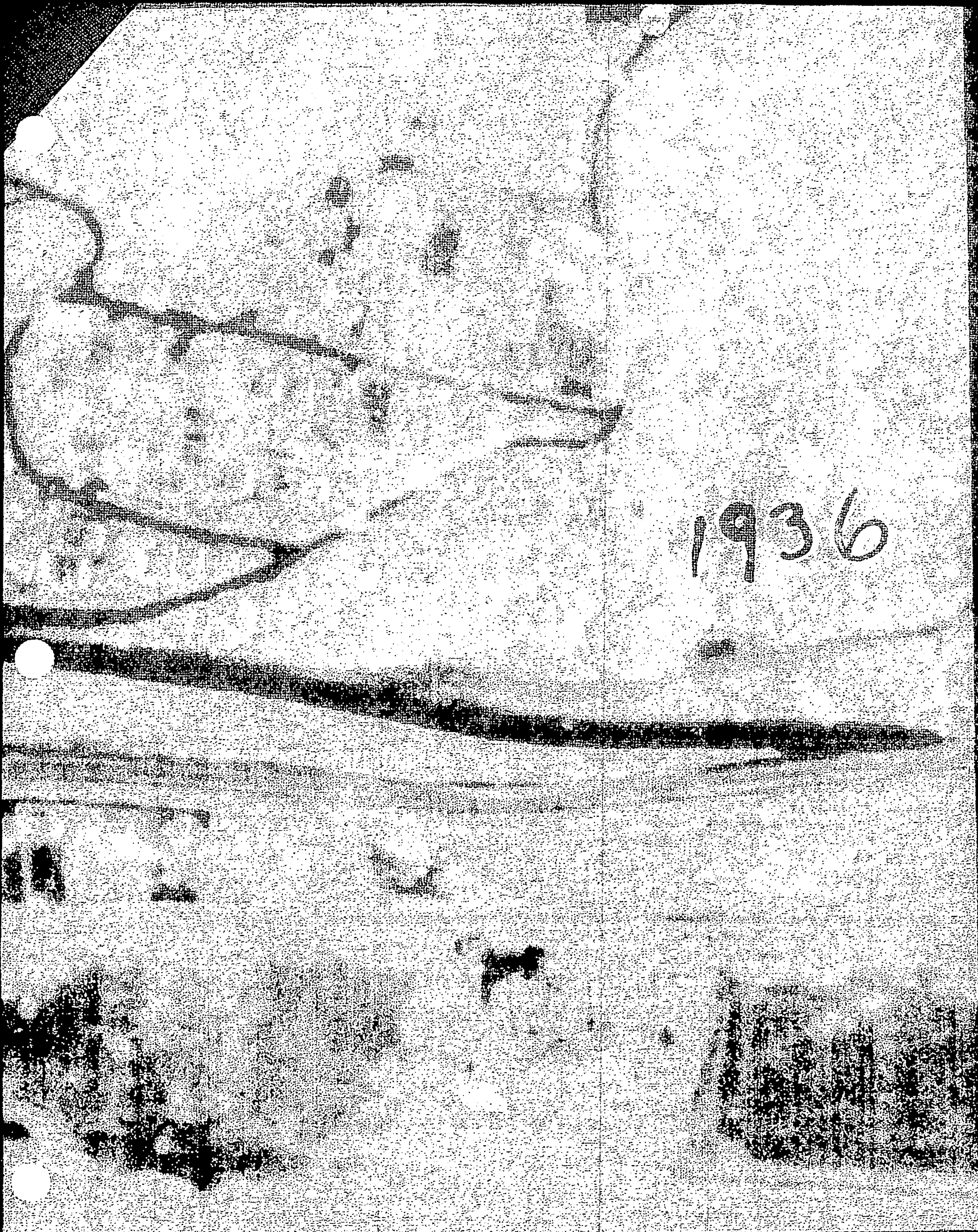


Figure 6
Petroleum Constituents in Groundwater


1936


1961

SUPPLEMENTAL TABLES

Table 2, (Anchor 2003), Soil Data

DO NOT QUOTE OR CITE.
This Document is currently under review by US EPA and its federal, state and tribal partners,
and is subject to change is whole or part.

Portland, Oregon

Analytical Methods and Parameters	Analytical Results mg/kg (ppm)																													
Boring Number	B-2			B-3		B-4	B-5		B-6		B-7			B-9	B-10	B-11	B-12	B-13	B-16		B-17		B-18		B-19		B-20	B-21		
Sample Depth (feet bgs)	10.5	20.5	25.5	20.5	25.5	20.5	10.5	20.5	10.5	15.5	10.5	15.5	20.5	20.5	20.5	15.5	15.5	10.5	12	24.5	12	23	16.5	24	15.5	21.5	23.0	5.0	18.0	23.0
Sample Date	4/15/1993			4/15/1993		4/15/1993	4/16/1993		4/16/1993		04/15/93			04/16/93	04/16/93	04/16/93	04/16/93	04/16/93	05/29/01		05/29/01		05/29/01		05/24/01		06/24/01	05/24/01		
Northwest Methods																														
Gasoline by NW TPH-Gx	ND>20	ND>20	ND>20	ND>20	ND>20	ND>20	ND>20	ND>20	ND>20	ND>20	270	2000	13	ND>20	ND>20	ND>20	ND>20	ND>20		ND>0.704	-	10.9	ND>0.532	1.14	ND>0.500	ND>0.617	ND>0.641	1,370.	ND>0.543	ND>0.667
Diesel by NW TPH-Dx	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	-	ND>50	ND>50	ND>50	ND>50	ND>50	ND>21.7	ND>28.2	ND>21.5	ND>22	ND>21.3	ND>24.7	-	ND>24.7	ND>26.0	ND>25.7	-	ND>26.7
Oil by NW TPH-Dx	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	-	ND>100	ND>100	ND>100	ND>100	200	ND>54.3	121	ND>53.8	ND>54.9	ND>53.2	ND>61.7	-	ND>61.7	ND>64.9	ND>61.7	-	ND>66.7
Total Lead by EPA 6010											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.4	-	-
VOCs by EPA Method 8260B or 8021																														
Benzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND>0.00309	-	**5.2**	ND>0.00272	-
Toluene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND>0.00309	-	ND>0.025	ND>0.00272	-
Ethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND>0.00309	-	23.4	ND>0.00272	-
Xylenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND>0.00926	-	134.9	ND>0.00815	-
Naphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.1	-	-
MTBE (methyl tert-butyl ether)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND>0.25	-	-
EDB (1,2-dibromoethane)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND>0.025	-	-
EDC (1,2-dichloroethane)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND>0.025	-	-
Isopropylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.58	-	-
n-Propylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.1	-	-
1,2,4-Trimethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59.8	-	-
1,3,5-Trimethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.7	-	-
PAHs by EPA 8270																														
Naphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo (a) anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo (b) fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo (k) fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo (a) pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno (1,2,3-cd) pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzo (ah) anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo (ghi) perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note:

# = reference level not established
bgs = below ground surface
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
\- = not analyzed

ND = not detected above detection limit indicated
OAR = Oregon Administrative Rules
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
VOCs = volatile organic compounds
Bold and shaded = Concentration in excess of reference level

1 Risk Based Decision Making for the Remediation of Petroleum-Contaminated Sites, Oregon Department of Environmental Quality, September 22, 2003
a. Occupational RBC for Soil Vapor Intrusion into Buildings
b. Construction Worker RBC for Soil Ingestion, Dermal Contact, and Inhilation
c. Occupational RBC for Soil Ingestion, Dermal Contact, and Inhilation

Analytical Methods and Parameters	Analytical Results - mg/kg (ppm)																								
Boring Number	B-22			B-23	B-24		B-25		B-26			B-27	B-28	B-29		B-30	MW-1	MW-2	MW-4		MW-5		MW-6	MW-7	Lowest RBC[1] Occupational Pathway and Construction Worker Pathways
Sample Depth (feet bgs)	7.0	15.5	22.0	23.0	23.5	27.0	6.0	12.0	6.0	18.0	22.0	3.5	4.0	15.0	23.0	5.0	15-16.5	10-11.5	10-11.5	5-6.5	15-16.5	22.5-24	24.5-26	25-26.5	
Sample Date	05/24/01			05/24/01	05/25/01		05/25/01		05/25/01			05/25/01	05/25/01	05/25/01		05/24/01	07/18/06	02/12/07	07/18/06	07/18/06	07/18/06	07/18/06	06/19/03	06/19/03	
Northwest Methods																									
Gasoline by NW TPH-Gx	-	61.3	1.31	ND>0.617	ND>0.649	ND>0.758	ND>0.704	ND>0.595	ND>0.568	ND>0.543	ND>0.694	ND>0.562	0.829	ND>0.543	ND>0.617	ND>0.543	-	-	-	-	-	-	ND>6.6	ND>7.2	13000 b
Diesel by NW TPH-Dx	ND>23.5	-	62.6	ND>24.7	ND>26.0	ND>30.3	ND>28.2	ND>23.8	460.	ND>21.7	ND>27.8	468.	560.	ND>21.7	ND>24.7	-	360.	40.	ND>35.0	ND>28	ND>27	96.	ND>34	ND>36	23000 b
Oil by NW TPH-Dx	ND>58.8	-	166.	ND>61.7	ND>64.9	ND>75.8	ND>70.4	ND>59.5	1,360.	ND>54.3	ND>69.4	6,010.	8,330.	ND>54.3	ND>61.7	-	ND>110	ND>130	ND>140	ND>110	ND>110	390.	ND>140	ND>150	40000 b
Total Lead by EPA 6010	-	-	-	-	-	3.28	3.75		-	-	-	-	3.03	-	-	5.89	4.2	15.9	21.	5.4	4.	32.5	16.3	12.8	750 b,c
VOCs by EPA Method 8260B o																									
Benzene	-	-	-	-	-	ND>0.005	ND>0.005	-	-	-	-	ND>0.005	ND>0.005	-	-	ND>0.005	ND>0.110	ND>0.00098	ND>0.0068	ND>0.0055	ND>0.0054	ND>0.0075	ND>0.0067	ND>0.0072	1.2 a
Toluene	-	-	-	-	-	ND>0.005	ND>0.005	-	-	-	-	ND>0.005	ND>0.005	-	-	ND>0.005	ND>0.110	ND>0.0011	ND>0.0068	ND>0.0055	ND>0.0054	ND>0.0075	ND>0.0067	ND>0.0072	39000 b
Ethylbenzene	-	-	-	-	-	ND>0.005	ND>0.005	-	-	-	-	ND>0.005	ND>0.005	-	-	ND>0.005	1.	ND>0.00071	ND>0.0068	ND>0.0055	ND>0.0054	2.5	ND>0.0067	ND>0.0072	28000 b
Xylenes	-	-	-	-	-	ND>0.010	ND>0.010	-	-	-	-	ND>0.005	ND>0.010	-	-	ND>0.010	2.04	ND>0.0019	ND>0.0068	ND>0.0055	ND>0.0054	2.733	ND>0.0067	ND>0.0072	19000 b
Naphthalene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	64.	ND>0.0011	ND>0.027	ND>0.022	ND>0.022	4.9	ND>0.027	ND>0.029	710 b
MTBE (methyl tert-butyl ether)	-	-	-	-	-	ND>0.010	ND>0.010	-	-	-	-	ND>0.01	ND>0.010	-	-	ND>0.010	ND>0.110	ND>0.00079	ND>0.0068	ND>0.0055	ND>0.0054	ND>0.0075	ND>0.0067	ND>0.0072	35 a
EDB (1,2-dibromoethane)	-	-	-	-	-	ND>0.005	ND>0.005	-	-	-	-	-	ND>0.005	-	-	ND>0.005	ND>0.420	ND>0.00098	ND>0.027	ND>0.022	ND>0.022	ND>0.030	ND>0.0067	ND>0.0072	0.37 a
EDC (1,2-dichloroethane)	-	-	-	-	-	ND>0.005	ND>0.005	-	-	-	-	-	ND>0.005	-	-	ND>0.005	ND>0.110	ND>0.00083	ND>0.0068	ND>0.0055	ND>0.0054	ND>0.0075	ND>0.0067	ND>0.0072	0.56 a
Isopropylbenzene	-	-	-	-	-	ND>0.005	0.013	-	-	-	-	ND>0.005	ND>0.005	-	-	ND>0.005	3.	ND>0.00084	ND>0.0068	ND>0.0055	ND>0.0054	7.	ND>0.027	ND>0.029	24000 b
n-Propylbenzene	-	-	-	-	-	ND>0.005	0.021	-	-	-	-	ND>0.005	ND>0.005	-	-	ND>0.005	18.	ND>0.00089	ND>0.027	ND>0.022	ND>0.022	ND>0.030	ND>0.027	ND>0.029	9300 b
1,2,4-Trimethylbenzene	-	-	-	-	-	ND>0.005	ND>0.005	-	-	-	-	ND>0.005	ND>0.005	-	-	ND>0.005	59.	ND>0.0011	ND>0.027	ND>0.022	ND>0.022	20.	ND>0.027	ND>0.029	840 a
1,3,5-Trimethylbenzene	-	-	-	-	-	ND>0.005	ND>0.005	-	-	-	-	ND>0.005	ND>0.005	-	-	ND>0.005	ND>7.8	ND>0.0047	ND>0.027	ND>0.022	ND>0.022	ND>0.970	ND>0.027	ND>0.029	140 a
PAHs by EPA 8270																									
Naphthalene	-	-	-	-	-			-	-	-	-	-	-	-	-	-	22.	0.026	0.041	ND>0.005	ND>0.0048	1.8	0.083	ND>0.005	710 b
Acenaphthylene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	ND>0.0048	0.011	0.011	ND>0.005	ND>0.0048	0.038	0.039	ND>0.005	#
Acenaphthene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.052	0.011	ND>0.0071	0.052	ND>0.0048	0.038	0.05	ND>0.005	16000 b
Dibenzofuran	-	-	-	-	-			-	-	-	-	-	-	-	-	-	0.014	ND>0.005	ND>0.0071	0.011	ND>0.0048	0.017	0.01	ND>0.005	#
Fluorene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.11	0.01	0.007	0.053	ND>0.0048	0.051	0.04	ND>0.005	12000 b
Phenanthrene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.24	0.15	0.055	0.44	0.009	0.49	0.34	0.013	#
Anthracene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.059	0.048	0.011	0.054	0.006	0.082	0.088	0.0068	90000 b
2-Methylnaphthalene	-	-	-	-	-			-	-	-	-	-	-	-	-	-	24.	0.011	0.008	ND>0.005	ND>0.0048	0.91	0.029	ND>0.005	#
Fluoranthene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.12	0.22	0.068	0.078	0.029	0.72	0.5	0.086	8900 b
Pyrene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.16	0.41	0.083	0.077	0.063	0.85	0.55	0.076	6700 b
Benzo (a) anthracene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.054	0.12	0.018	0.009	0.016	0.33	0.29	0.063	2.7 c
Chrysene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.06	0.15	0.029	0.014	0.026	0.56	0.36	0.061	270 c
Benzo (b) fluoranthene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.032	0.94	0.023	0.012	0.016	0.83	0.19	0.037	2.7 c
Benzo (k) fluoranthene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.039	0.95	0.02	0.013	0.018	0.65	0.28	0.054	27 c
Benzo (a) pyrene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.036	0.15	0.034	0.014	0.023	**0.92**	0.44	0.066	0.27 c
Indeno (1,2,3-cd) pyrene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.03	0.12	0.033	0.021	0.023	2.	0.33	0.04	2.7 c
Dibenzo (ah) anthracene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	ND>0.0048	0.13	ND>0.0071	ND>0.005	ND>0.0048	0.15	0.056	0.0091	0.27 c
Benzo (ghi) perylene	-	-	-	-	-	ND>0.050	ND>0.050	-	-	-	-	ND>0.050	ND>0.050	-	-	ND>0.050	0.041	0.12	0.049	0.022	0.025	2.3	0.36	0.034	#

Note:

# = reference level not established
bgs = below ground surface
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
- = not analyzed

ND = not detected above detection limit indicated
OAR = Oregon Administrative Rules
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
VOCs = volatile organic compounds
Bold and shaded = Concentration in excess of reference level

1 Risk Based Decision Making for the Remediation of Petroleum-Contaminated Sites, Oregon Department of Environmental Quality, September 22, 2003
a. Occupational RBC for Soil Vapor Intrusion into Buildings
b. Construction Worker RBC for Soil Ingestion, Dermal Contact, and Inhilation
c. Occupational RBC for Soil Ingestion, Dermal Contact, and Inhilation

Appendix A-5

Gasco (NW Natural, Koppers, Pacific Northern Oil)

GASCO Site
CSM Site Summary – Appendix A-5

GASCO

Oregon DEQ ECSI #: 84

7900 NW St. Helens Road, Portland, Oregon 97210
DEQ Site Mgr: Mr. Matt McClincy
Latitude: 45.5774
Longitude: -122.7563
Township/Range/Section: 1N/1W/12

River Mile: 6 West bank

LWG Member ☒ Yes ☐ No

Upland Analytical Data Status: ☐ Electronic Data Available ☒ Hardcopies only

1. SUMMARY OF POTENTIAL CONTAMINANT TRANSPORT PATHWAYS TO THE RIVER

The Gasco site comprises 44.65 acres along the western bank of the Willamette River in a section of northwest Portland zoned by the city as "Heavy Industrial". The property, situated approximately 2,000 feet upriver of the St. John's Bridge, is generally rectangular in shape (Figure 1). The central portion of the site is currently used by NW Natural as a liquefied natural gas (LNG) storage and distribution facility, while the southern portion of the site is leased by Koppers Industries, Inc. (KI) for use as a coal tar pitch distribution facility, and the northern portion of the site is leased by Fuel and Marine Marketing, Inc. (FAMM) for use as a bulk fuel storage and distribution terminal. Unless otherwise noted in this document, the terms "Gasco site" or "site" refers to the entire site including the leased areas.

The current understanding of the transport mechanism of contaminants from the uplands portions of the site to the river is summarized in this section and Table 1, and supported in following sections.

1.1. Overland Transport

There is no or minimal potential for direct overland transport of chemicals in site soils to the river. There is some potential for chemicals in site soils to be transported in stormwater to the stormwater/wastewater point-source discharge to the Willamette River (Section 1.4), and there is some potential for erosion of shoreline soils (Section 1.2).

1.2. Riverbank Erosion

Currently, there is some potential for overland transport of chemicals in shoreline soils to the river. The majority of the site shoreline is vegetated or covered with rip rap. However, some locations of minimally vegetated soils exist and may contain chemicals that could be transported to the river. NW Natural has proposed a shoreline stabilization plan, which is currently under review by DEQ.

1.3. Groundwater

There are no known preferential zones of groundwater discharge to the Willamette River at the site. Dissolved contaminants are likely discharging to Willamette River sediments from the upper portion of the Alluvial Water-Bearing Zone. Evidence of on-going non-aqueous phase liquid discharge to Willamette River sediments have not been identified to date. Additional investigation activities related to this potential transport pathway is scheduled for summer 2004.

1.4. Direct Discharge (Overwater Activities and Stormwater/Wastewater Systems)

NW Natural has one combined stormwater/wastewater outfall that discharges to the embankment above the Willamette River at the subject property. Low-level benzene and PAH concentrations were identified in a sample of surface water within a drainage ditch carrying stormwater/non-contact cooling water to the outfall. The water in the drainage ditch includes stormwater runoff from a majority of the Gasco site, with the exception of the KI lease area.

Stormwater within the KI pitch handling areas feeds into the KI tank farm area where it is collected by a concrete collection sump. The run-off is then pumped to storage tanks, where the water is sampled prior to batch discharge in accordance with KI's permit requirements. The batch discharge, as well as surface water runoff from two catch basins located in non-process areas of the KI area, is discharged through KI's NPDES-permitted outfall, which drains to an open ditch located at the southern corner of the property. This ditch ultimately leads to City of Portland Outfall 22C, located on the Willamette River immediately downstream of the Burlington Northern Santa Fe Railroad Company bridge.

Several overwater spills have been documented at the site, with material spilled including coal tar pitch dust (Koppers in 1969), several gallons of fuel oil (PNO in 1998), several gallons of oily water (NW Natural in 2000), and several gallons of coal tar pitch (Koppers in 2003). In addition, former oil gas operations at the site resulted in direct discharge of oil and tar to Willamette River sediments prior to construction of on site settling pond in 1941.

1.5. Relationship of Upland Sources to River Sediments

Aerial photographs and site history clearly indicate that substantial direct deposition to offshore sediments of oil gasification by-products has occurred for a number of years earlier in the 20th century. From 1913 to 1925, wastewaters and tars not usable as fuel would have been discharged to drainage features leading from the production area to the Willamette River. Prior to 1941, waste by-products from the oil gasification process that did not have a market (wastewater with petroleum emulsions, tars, and spent oxide) would have continued to have been discharged to low-lying areas of the site and drainage features leading from the production area to the Willamette River. These waste by-products include both relatively oily and tarry substances that may also have become substantially weathered in the river environment over the years. Consequently, these substances are found in significant deposits such as the "tar body" and throughout the sediment core profiles in much of the nearshore sediments. These historical direct discharges were of substantial magnitude and chemical concentration. Consequently, it is difficult to discern the presence or, if present, the importance of current relatively low level sources of chemicals from the upland in the potential form of minor soil erosion, stormwater inputs, and/or groundwater discharges. However, current direct discharges such as seeps of NAPL or movement of tar

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in soils to the sediments have not been observed since remedial investigations of the site commenced in the mid 1990s. See Final CSM Update.

1.6. Sediment Transport

The GASCO site is located along the west bank of the lower Willamette from approximately RM 6.1 to 6.4. This area is near the center of the transport/non-depositional zone that occurs where the river is relatively narrow between RM 5 and 7 (Integral et al. 2004). The Sediment Trend Analysis® results suggest that episodic net erosion and net accretion occurs in the western portion of the river here, while dynamic equilibrium is dominant in the center and eastern sections of the river. Along this stretch of river, the riverbank drops sharply from the uplands to channel depth. The time-series bathymetric change data over the 25-month period from January 2002 through February 2004 (Integral and DEA in prep.) indicate that either no change or small-scale (< 1 foot) net sediment accretion is predominate from the + 5 to the –20 foot NAVD88 contour along the upstream half of the site. Around the dock structure at the downstream portion of the site, some small-scale net erosion is evident. The main channel offshore of the site, beyond the –30 foot NAVD88 contour, is a mosaic of small-scale erosion and no change areas. Periodic monitoring of beach sediment stakes placed at GASCO indicated sediment accretion of about 10 cm on the lower beach (+7 foot NAVD88) from July 2002 through January 2004 (Anchor 2004). The mid-beach stake (+10 foot NAVD88) showed sediment accretion up to 10 cm from July 2002 to November 2002 and then mostly exhibited net scour (up to 29 cm in extent) through January 2004. The high beach stake (+12 foot NAVD88) showed no change through October 2002 and was then lost.

2. CSM SITE SUMMARY REVISIONS

Date of Last Revision: September 13, 2004

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3. PROJECT STATUS

Activity		Date(s)/Comments
PA/XPA	☒	1987 (EPA); 1993 (DEQ)
RI	☒	1995 through present
FS	☐	
Interim Action/Source Control	☒	Drilled-out, sampled, and sealed two deep pipeline cathodic protection wells in 2000 to ensure lack of preferential zone of contaminant migration into underlying bedrock. Initiated DNAPL recovery a well location northeast of former Retort Area in 2001
ROD	☐	
RD/RA	☐	
NFA	☐	

DEQ Portland Harbor Site Ranking (Tier 1, 2, or 3): 1

4. SITE OWNER HISTORY

[Primary Source: ECSI file, RI reports, site investigation reports, and DEQ Staff Report.]

Owner/Occupant	Type of Operation	Years
Portland Gas and Coke Company (owner)	Oil Manufactured Gas Plant	1913 - 1956
NW Natural [formerly Portland Gas and Coke) (owner)]	Liquefied Natural Gas Storage and Distribution	1969 - present
Koppers Corporation (tenant) – southwestern portion of site	Coal Tar Formulation, Storage and Distribution	1965 - 1973
Koppers Corporation (tenant) – southwestern portion of site	Electrode Grade Pitch Manufacture and Distribution	1973 - 1977
Koppers Industries, Inc. (tenant) – southwestern portion of site	Solid and Liquid Coal Tar Pitch Storage and Distribution	1977- present
Pacific Northern Oil (tenant) – northern portion of site	Bulk Fuel Storage and Distribution	1965 - 1999
Fuel and Marine Marketing (tenant) – northern portion of site	Bulk Fuel Storage and Distribution	1999 - present

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5. PROPERTY DESCRIPTION

The Gasco site comprises 44.65 acres along the western bank of the Willamette River in a section of northwest Portland zoned by the city as "Heavy Industrial" (Supplemental Figures 1 and 2).

The property, situated approximately 2,000 feet upriver of the St. John's Bridge, is generally rectangular in shape. Property boundaries include the Willamette River to the northeast; a Burlington Northern Santa Fe Railroad Company (BNSF) railroad right-of-way to the southwest; a property line shared with Siltronic to the southeast; and a property line shared with the U.S. Army Corps of Engineers Moorings Station (U.S. Moorings) to the northwest. U.S. Highway 30 (NW St. Helens Road), a former rock quarry, an automobile impound yard, and the Tualatin Mountains lie beyond the BNSF right-of-way to the southwest.

Site surface features include buildings, storage tanks, and equipment used in industrial processes currently ongoing at the site. The site ranges from mostly paved or gravel-covered in the southwestern, western, and central portions of the property, to mixed grass and trees in the northern and southeastern portions of the property. The southeastern portion of the site (Former Tar Pond Area) occupies approximately 10 undeveloped acres, and is primarily covered with grasses and trees with a small (approximately 3/4-acre) seasonal pond feature.

Additional site features include a utility easement that crosses the southwestern portion of the property. Utilities that exist within the easement include oil, gasoline, natural gas, water, and sewer pipelines. In addition to the preceding, numerous utilities (e.g., water, oil, stormwater) exist as part of the site infrastructure.

The ground surface at the site slopes gradually northeastward towards the Willamette River with surface elevations ranging from approximately 38 feet above mean sea level (msl-City of Portland datum) at the southwestern portion of the property to approximately 23 to 30 feet msl at the top of the river bank. The riverbank, composed both of areas of rip rap and areas of non-armored soils, slopes steeply to an elevation of approximately 5 to 8 feet msl, below which exists the shoreline with a more gradual slope.

Placeholder: whether the riparian area and /or river bed are leased from DSL.

6. CURRENT SITE USE

The central portion of the site is currently used by NW Natural as a liquefied natural gas (LNG) storage and distribution facility, while the southern portion of the site is leased by Koppers Industries, Inc. (KI) for use as a coal tar pitch distribution facility, and the northern portion of the site is leased by Fuel and Marine Marketing, Inc. (FAMM) for use as a bulk fuel storage and distribution terminal.

6.1. Liquefied Natural Gas Storage

NW Natural (then NW Natural Gas Co.) constructed the company's first LNG storage tank on the Gasco site in 1969. This LNG storage facility is used to liquefy natural gas during times of low peak demand for storage until the gas is needed during times of peak demand, typically during the winter heating season. In addition to the LNG storage tank, NW Natural maintains LNG storage control and distribution facilities at the site.

6.2. Coal Tar and Pencil Pitch Distribution

Koppers Inc. (Carbon Materials and Chemicals Division), currently leases the southwestern portion of the Gasco site (approximately 6.4 acres) at 7540 NW St. Helens Road (ECSI #2348).

KI imports coal tar pitch via bulk and/or liquid cargo vessels. The product is then stored at the site prior to distribution via tank truck or tank rail cars. Specifically, solid coal tar pitch (e.g., pencil pitch) arrives at the site by truck, while liquid coal tar pitch is imported via a bulk cargo vessel. Liquid coal tar pitch operations at the facility began in 1999, with the objective being the phase out of management of solid pencil pitch. The liquid coal tar pitch is received at the NW Natural Gasco dock on the Willamette River, where it is pumped from the vessel, through a heated aboveground pipeline to a storage tank on the KI lease area. KI retains stockpiles of solid pencil pitch on site in a large structure located near the eastern corner of their lease area.

6.3. Marine Fuel Storage and Distribution

Pacific Terminal Services, Inc. (PacTerm), under contract with Fuel and Marine Marketing (FAMM), operates a fuel storage and distribution facility at the northern portion of the site. From the 1960s and until FAMM's involvement in 1999, the distribution facility was operated by Pacific Northern Oil (PNO). The terminal receives, stores, blends, and ships marine fuels and lubricants, utilizing both barge and truck for transport. FAMM uses two aboveground storage tank (AST) farms for storage and distribution of fuel.

7. SITE USE HISTORY

7.1. MGP Operations

Portland Gas & Coke (PG&C) constructed an oil MGP, known as Gasco, on the subject property in 1913. The plant initially produced town gas and pressed lampblack briquettes that were sold in the area as fuel. In 1923, the gasification process was modified to optimize aromatic generation and light oil recovery for use as motor fuel. Tar recovery and refining were incorporated into the process in 1925 to provide tar for use as a road binder. During the 1930s, the plant expanded, and in 1941 a coking plant began production of electrode grade coke and high BTU gas.

The Gasco facility used the "Pacific Coast Oil Gas Process" throughout the plant's life. This process involved thermal cracking of oil at near atmospheric pressure in a cylindrical shell containing heated refractory checker brick. In this process, heavy oils were introduced to the gasified vessel after pre-heating the checker brick to 2,000°F. These oils were then thermally cracked as they moved downward through the gasifier. During the life of the Gasco plant, it is reported that approximately 70,000,000 barrels (2,940,000,000 gallons) of petroleum feedstock [8.4 degree API (specific gravity of 1.011) oil] were processed. This process generated the following products and by-products: oil gas, lampblack, tar, and light oil.

In 1941, a coke oven was installed at the plant to generate electrode grade coke and high BTU oil gas for re-forming in the existing retorts, using 8.4 degree API feedstock oil and lampblack as a feed source and generating the following products and by-products: oil gas, coke, tar, and creosote oil.

In addition to the preceding by-products, spent oxide (also called purifier box wastes) was generated from the use of iron oxide (iron-impregnated wood chips) or lime as solid reactants for the removal of sulfur from the oil gas. Spent oxide is primarily a blend of iron sulfides, sulfur, iron oxides and wood substrate and/or lime; however, spent oxide material may also contain hydrocarbons that passed through the upstream gas processing equipment, as well as cyanides that would be removed from the gas along with the sulfur.

Due to the large scale of operations at the Gasco site, economic recovery of many of the by-products typically wasted at other plants of this type, was possible, thereby reducing the quantities of waste from this site. Gasification by-products were refined to produce the following products at the Gasco site:

- lampblack briquettes
- soft pitch
- specification tars and tar distillates
- specification creosote
- hard pitch
- electrode grade pitch
- crude naphthalene
- crude benzene
- motor fuel
- toluene
- xylene
- solvent naphtha

Once natural gas became available in the 1950s, much of the MGP was shut down, with the last full year of plant operation occurring in 1955. With the arrival of natural gas, PG&C changed its name to the Northwest Natural Gas Company, and more recently to NW Natural. The Northwest Natural Gas Company constructed a LNG plant at the site in the late 1960s, at which time most of the old gasification plant was demolished and associated underground utilities were removed.

7.2. Coal Tar Pitch Distillation

KI's predecessor, Koppers Company, Inc. (Koppers Co. – now Beazer East, Inc.), operated a coal tar distillation facility at the southwestern portion of the property from 1966 to 1973. During this time frame Koppers produced chemical oil, creosote, and pitch from coal tar distillates. From 1974 through 1977 Koppers Co. manufactured electrode grade pitch, a product derived from both coal tar and petroleum residuals.

8. CURRENT AND HISTORIC SOURCES AND COPCS

The understanding of historic and current potential upland and overwater sources at the site is summarized in Table 1. Site features are shown in Supplemental Figure 3. The following sections

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provide a brief overview of the potential sources and COPCs at the site, based primarily on information provided in HAI (1998), Anchor (2001a,b), and the DEQ ECSI database.

8.1. *Uplands*

Potential sources of contamination at the Gasco site are subdivided into two general areas: 1) process or operational areas, and 2) by-product and residue placement areas. These potential source areas were identified from a review of the operational history of the site, facility plans, and aerial photographs. The locations of the potential source areas at the site are depicted in Supplemental Figure 3 and are identified below and in Table 1.

The historical and/or current process areas of potential concern at the site are identified as:

- Former Retort Area
- Former Tar Processing Area
- Former Light Oil Plant/Koppers Co. Plant/Current KI Tank Farm
- Former Koppers Co. / Current KI pencil pitch storage area
- Former Naphthalene Plant
- Former Coke Oven Area
- Former Pitch Plant/Tar Loading Area

The by-product and residue placement areas of potential concern at the site are identified as:

- Former Lampblack Storage/Central Fill Area
- Former Spent Oxide Storage Area
- Former Tar Settling Ponds/Southern Fill Area
- Former Koppers Co. Land Disposal Area
- Former By-Product incorporation into fill

With regard to contaminants of interest, polynuclear aromatic hydrocarbons (PAHs) are present in the raw materials, by-products, and residues of the oil gasification process and also in products of Koppers Co. past, and KI's current processes at the site, including heavy oils, oil tars, lampblack, pencil pitch, creosote, pencil pitch, and coke. PAHs are also present in the fuels stored at the FAMM facility, including bunker and diesel fuels. PAHs are generally considered to be the primary contaminants of interest (COIs) at MGP sites.

Volatile aromatic hydrocarbons (e.g., benzene, toluene, ethylbenzene, xylene) are present in the motor fuels and light oils that were produced at the Gasco facility, and are COIs for the Gasco RI.

Phenols, although predominantly attributable to coal MGP processes, could be present in the tar by-products of the oil gasification process or as a component of Koppers Co. creosote formulation, and are therefore identified as COIs.

Metals, particularly arsenic, chromium, copper, lead, nickel, and zinc may be related to spent oxide / purifier box wastes at MGP sites, and therefore these metals have been identified as COIs.

Cyanide may be present at the site due to the use of oxide reactors (for purifying the manufactured gas) and the storage of spent oxide materials at the site.

No records of chlorinated solvent, herbicide, or pesticide use in process activities historically conducted at the Gasco site have been identified, and therefore such constituents have not been included as COIs.

Based on the site-specific Level 2 Human Health and Ecological Risk Assessment (Anchor 2001a), chemicals of potential concern (COPCs) recommended for soil at the site include chromium, zinc, benzene, ethylbenzene, xylenes, and select PAHs. Groundwater chemicals of interest that exceed AWQC include select PAHs, benzene, cyanide, arsenic, chromium, copper, lead, nickel, and zinc (Anchor 2001a).

8.2. Overwater Activities

☒ Yes ☐ No

- FAMM conducts overwater transfer of bulk petroleum from barge to their bulk storage facility.
- KI conducts overwater transfer of heated liquid coal tar pitch from barge to their bulk storage facility.

Placeholder: Include any information about the owner having and exercising a statutory right to an overwater facility.

8.3. Spills

Known or documented spills at the Gasco site were obtained either from DEQ SPINS database for the period of 1995 to 2003, from oil and chemical spills recorded from 1982 to 1989 by the U.S. Coast Guard and the National Response Center's centralized federal database [see Appendix E of the Portland Harbor Work Plan (Integral et al. 2004)], or from DEQ correspondence. These spills are summarized below.

Date	Material(s) Released	Volume Spilled (gallons)	Spill Surface (gravel, asphalt, sewer)	Action Taken (yes /no)
10/69	coal tar pitch dust (Koppers)	unknown	Willamette River	unknown
1998	fuel oil (PNO)	few gallons	Willamette River	unknown
03/2000	oily water (NW Natural)	<25 gallons	Riverbank	yes
10/22/03	coal tar pitch (KI)	2 gallons	Willamette River	no

9. PHYSICAL SITE SETTING

Numerous phases of environmental investigation activities have been completed at the Gasco site since initiation of the Remedial Investigation in September 1995. Investigation activities have included soil boring installation, monitoring well installation, surface soil sampling, surface water sampling, sediment sampling, and air monitoring. Currently there are 24 groundwater monitoring wells at the site, ranging in depth from 22 feet below ground surface (bgs) to 175 feet bgs, while approximately 56 non-monitoring-well-related soil borings have been installed across the site to date. The following information on the conceptual geology and hydrogeology site model is summarized from the Phase I RI Report (HAI 1998), and subsequent subsurface investigation reports prepared for the site. Monitoring well and soil boring locations are provided in the Supplemental Figure 2.

9.1. Geology

The geologic units of interest at the subject site can be subdivided as follows, from youngest to oldest:

- Surficial Fill Deposits
- Alluvial Deposits
- Columbia River Basalt Group

The distribution of the above-identified geologic units beneath the site, as identified during RI activities, are generalized on cross-section A-A' and B-B' in Supplemental Figures 4 through 6.

9.1.1. Surficial Fill Deposits

Much of the Gasco property has been extensively filled through time, beginning with initial MGP site development activities between 1905 and 1913. Fill placement for initial site development occurred within the main plant area (western property), extending to the river at the central portion of the site in the vicinity of the former briquette storage and gas purifier area, near the main dock and petroleum storage tank area (1936 aerial photograph). Remaining low-lying areas, primarily to the southeast (lampblack storage and tar pond area) received MGP by-product placement through time (1940, 1952 aerial photographs), and likely received soils from the excavation of the LNG tank containment basin at the central portion of the site in 1967 and 1968 (1968 aerial photograph). Spent oxide materials historically stockpiled at the northern portion of the property were removed between 1968 and 1975, and may have been placed in low-lying areas at the southern portion of the property, potentially extending onto the adjacent Siltronic property to the south. By 1975, the southern portion of the property was predominantly filled; however, shallow water retention ponds had been constructed in the former tar pond area (1978 and 1980 aerial photographs). These ponds were filled in 1981, at which time filling of the site was essentially complete.

The thickness of the surficial fill ranges from approximately 2 feet along the western portion of the site near the Tualatin Mountains, to a maximum of approximately 30 feet in the northern and eastern portions of the site, near the Willamette River. An isopach map depicting the thickness of the surficial fill across the site, as identified in site borings, is provided in Supplemental Figure 7.

Much of the fill at the site, especially in the northwestern and central areas, was found to consist of poorly graded sands and silty sands that was likely hydraulically placed river-dredge material. Other areas of the site were found to contain lampblack and/or pencil pitch material, solidified tars, oil, quarry reject rock, and building debris, which were either historically discharged to low areas of the site and/or were incorporated into the fill when these areas were brought to current grade.

In addition to the overall build-up of ground surface elevations, filling activities at the Gasco site have resulted in the removal of two site drainage features, including a creek in the central portion of the site (parallel to the river) and a drainage feature/low area formerly located adjacent to the Lampblack Storage Area, where surface water run-off and MGP wastes were discharged prior to construction of the Tar Ponds in 1941. Based on review of historical aerial photographs of the site, it appears that this ditch was filled or blocked some time between 1940 and 1952, while the entire southeastern portion of the site (tar ponds and drainage area) was filled to their existing grade in the mid-1970s.

The location of the former drainage feature described above as well as a general estimate of the shoreline location as it evolved due to site filling through time (based on review of aerial photographs) is depicted in Supplemental Figure 8.

9.1.2. Alluvial Deposits

Underlying the surficial fill at the site are Quaternary-age alluvial deposits, composed of unconsolidated sands and silts, that range in thickness from approximately 30 feet near St. Helens Road to an estimated thickness of approximately 200 feet adjacent to the Willamette River near the northern corner of the adjacent Siltronic site.

Borings installed by HAI at the Gasco site encountered a laterally extensive fine-grained silt unit, with minor clay content, at the upper portion of the undifferentiated Alluvial Deposits. Small sand lenses and rootlet zones are present within portions of the silt unit. Fine to medium-grained sands, silty sands, sandy silts, and relatively thin interbedded silts were encountered below the silt unit within the undifferentiated Alluvial Deposits. A thin layer consisting of medium to coarse-grained sandy gravel has been observed at the base of the Alluvial Deposits at the Gasco site and the adjacent Siltronic site.

As depicted in Supplemental Figure 9, the top of the silt unit was encountered at elevations ranging from 15 to 35 feet msl at the southwestern portion of the site, sloping to the northeast towards the Willamette River where it was encountered at elevations of approximately 0 to 10 feet msl.

The thickness of the silt unit is greatest in the central-southeast portion of the site, where thicknesses of up to 35 feet have been identified (boring MW-11). The silt unit appears to thin in all directions from this area of the site, and appears to be locally absent and/or transition to a silty sand at certain areas in the vicinity of the Willamette River.

Beneath the silt unit, the alluvial deposits were found to typically consist of sand with interbedded lenses of silt, sandy silt, or silty sand. The sand has been described as grey in color with localized areas of brown coloration, fine-grained, well sorted / poorly graded, sub-round to angular, and locally micaceous. The silt / sandy silt lenses identified within the sand were typically grey in coloration, and typically contained small rootlets and shell fragments less than 1 mm in diameter.

The base of the alluvial deposits was observed in borings for wells MW-12, MW-14, and MW-15, all installed to the top of underlying basalt bedrock as part of the RI. At well locations MW-12 and MW-15, brown, fine- to medium-grained sands typical of the shallower depths were identified immediately above the basalt bedrock (encountered at depths of 32 feet bgs and 64 feet bgs, respectively). At the MW-14 location, approximately 6-inches of rounded and angular gravels were identified immediately above bedrock (108 feet bgs) and below the fine- to medium-grained sands that are more typical of the bulk of the alluvial deposits.

9.1.3. Columbia River Basalt Group

The oldest and lowermost geologic unit of interest at the site consists of the Columbia River Basalt Group. The Miocene-age Columbia River Basalt Group, composed of a series of individual lava flows, generally forms the base (bedrock) of the Portland Basin and outcrops immediately to the southwest of the Site in the Tualatin Mountains.

A bedrock surface elevation map, utilizing RI data as well as data obtained from descriptions provided from 19 geotechnical soil borings that were installed at the site prior to development in 1913, is depicted in Supplemental Figure 10. From the Tualatin Mountain outcropping, the basalt surface dips steeply to the northeast, with the top of the basalt lying at an elevation near mean sea level (a depth of approximately 36 feet bgs) in the southern corner of the site (as observed at the MW-12-36 well location), to depths of 215 feet bgs near the northern corner of the adjacent Siltronic site (boring B-1-8) / southeastern corner of the Gasco site.

9.2. Hydrogeology

As described above, numerous investigative explorations completed at the site show that the site stratigraphy consists of fill underlain by Quaternary deposits that in turn are underlain by Columbia River Basalt. Groundwater occurs in three principal hydrologic zones beneath the site, which from top to bottom include: 1) the unconfined surficial fill water-bearing zone (WBZ), 2) the semi-confined alluvial WBZ, and 3) the confined bedrock aquifers in the Columbia River Basalts. Each water-bearing zone is described below in more detail.

9.2.1. Surficial Fill WBZ

Based on site investigation results, the thickness of the fill ranges from 2 feet along the southwest portion of the site to a maximum of 30 feet in the central and western portions of the site. The fill predominantly consists of sands and silty sands (dredge sands) with debris. There are 10 groundwater monitoring wells at the site presently screened within the Surficial Fill WBZ.

The saturated thickness of the fill fluctuates seasonally across the site from 3 to 27 feet bgs. The groundwater flow direction is northeasterly towards the Willamette River within this unit, with an average hydraulic gradient of 0.017. A depression in the water table is apparent in proximity to the LNG containment basin, with localized flow towards the basin, likely a result of the active pumping of groundwater seepage from this basin. The hydraulic conductivity of the unit ranges from 0.0067 ft/day to 26 ft/day with an average of 3.9 ft/day. Average flow velocities range from 0.0007 ft/day to 2.6 ft/day. A downward vertical hydraulic gradient is typical between the Surficial Fill WBZ and the underlying Alluvial WBZ, with the downward vertical gradient (potential) commonly ranging from 0.04 to 0.40 across the site (HAI, 1998).

Results of continuous water level monitoring within the Surficial Fill WBZ did not identify a short-term direct relationship between tidal fluctuations of the Willamette River and water levels within the Surficial Fill WBZ. However, long-term, seasonal fluctuations in river level were generally matched by similar fluctuations of groundwater level within the Surficial Fill WBZ wells (HAI, 1998).

9.2.2. Alluvial WBZ

Underlying the fill are Quaternary deposits composed of unconsolidated silts and sands ranging in thickness from approximately 30 feet near St. Helens Road, to greater than 200 feet adjacent to the Willamette River near the southern corner of the site. The upper portion of the Quaternary deposit is predominantly silts, while the lower deposits contain sands and silty sands with interbedded silts. The upper silt deposit, which thins towards the river and appears locally absent adjacent to the river, acts as a confining unit across much of the site. There are 14 groundwater monitoring wells at the site presently screened within the Alluvial WBZ, which for the purpose of evaluation, has been arbitrarily subdivided into upper, intermediate, and deep zones.

The groundwater flow direction within the Alluvial WBZ is northeast toward the Willamette River, with a significant flattening of the gradient within approximately 300 feet of the riverbank. Specifically, hydraulic gradients of between 0.020 and 0.030 (toward the river) are typical for the central portion of the site, while gradients ranging from 0.001 (toward the river) to 0.0030 (to the south-southwest, away from the river) are typical for the portion of the site located within 300 feet of the river. Across the site exists an overall average hydraulic gradient of 0.016, an overall hydraulic conductivity of 0.79 ft/day, and an average groundwater flow velocity of 0.07 ft/day (HAI, 1998).

Vertical hydraulic gradients between intermediate-depth Alluvial WBZ well and deep Alluvial typically fluctuate from between –0.002 to -0.02 (upward) and between 0.002 and 0.008 (downward), with the downward gradient occurrence predominating. Further, a slight upward hydraulic gradient ranging from -0.0005 to –0.002 is typical between deep Alluvial WBZ wells MW-5-175 and MW-5-100 (HAI, 1998 and 2004).

Continuous water level monitoring within the Alluvial WBZ and the Willamette River indicates groundwater levels in the Alluvial WBZ are strongly affected by tidal fluctuations, as well as by longer term increases and decreases in river level (HAI, 2003).

9.2.3. Confined Columbia River Basalt Aquifer

Water-bearing zones within the Columbia River Basalt are not monitored at the site. A log for an abandoned industrial water supply well at the site documented a water-bearing zone at a depth of 258 feet bgs between two basalt layers (an interflow zone). No yield information is available for this well, but well yield data provided on logs for former industrial supply wells within the vicinity of the site that were/are open within bedrock indicate yields ranging from approximately 20 gpm to over 200 gpm (HAI, 2000).

During the decommissioning of two deep pre-existing cathodic protection boreholes at the southwestern portion of the site identified measurable groundwater production within bedrock beginning at a depth of approximately 80 feet bgs (approximately 40 feet below bedrock surface), with the production of an estimated 15 to 20 gpm during drilling. This rate of groundwater production remained relatively constant until reaching a depth of 250 feet bgs, at which point groundwater production increased to an estimated 80 gpm during drilling. The preceding rate of groundwater production remained relatively constant until reaching a depth of 300 feet bgs. At 300 feet bgs, groundwater production increased to a roughly estimated rate of 1,500 gpm during drilling, causing available water containment (60,000 gallons) to quickly reach capacity. It is not anticipated that such a flow rate would be sustainable in the long-term (HAI, 2002).

9.2.4. Seep Locations

One groundwater seep has been identified above high tide level as interpreted from the presence of iron (ferric hydroxide) staining of rock material overlying fine-grained beach material across an approximate 25-foot length of rock immediately south of the main FAMM/KI dock walkway (GSI 2003). Quarterly riverbank inspections conducted by NW Natural have not identified active groundwater discharge to date, although the staining does suggest seasonal discharge. Another area of iron staining was noted beneath the site stormwater and industrial wastewater outfall, which discharges water to the top of the bank, with the staining present along the path of outfall discharge along the embankment to the river. A groundwater seep associated with this outfall has not been identified.

10. NATURE AND EXTENT *(Current Understanding)*

The current understanding of the nature and extent of contamination for the uplands portions of the site is summarized in this section. When no data exist for a specific medium, a notation is made.

10.1. Soil

10.1.1. Upland Soil Investigations

☒ Yes ☐ No

Since initiating RI activities at the site in September 1995, approximately 73 soil borings with collection of surface and subsurface soil samples have been installed across the site. The soil samples were analyzed for COIs that are present in the raw materials, by-products, and residues from site operations (see Section 8.1 for discussion of COIs). Areas of greatest impact within soil generally correlate with locations where visible oil, tar, or carbon pitch (e.g., lampblack or pencil pitch) have been identified, with such areas generally extending across the central and southern portions of the property as a result of incorporation of MGP by-products into surficial fill, and as a function of apparent releases from source areas, as described below. Visible oil and tar are indicated on the borings shown in cross-sections A-A' and B-B' in Supplemental Figures 4 through 6. Residual oil has been identified in soil borings installed throughout the southern and central portion of the site, primarily corresponding to the locations of the former Light Oil Plant / Koppers Tank Farm and the adjacent rail spur, northeastward through the former Tar Ponds, and northwestward through the area of the former Retort Area. Additionally, two apparently small and isolated areas of residual oil contamination have been identified in borings installed in the vicinity of the former Spent Oxide Storage area (MW-1 and B-1) and the FAMM tank farm (GT-1). The widespread nature of oil impacts within the surficial fill across much of the southwestern and southeastern portions of the property make interpretation of individual sources difficult, although the former Light Oil and Koppers Tank Farm and adjacent railway siding, the former Retort Area, the former Coke Oven / Koppers Land Disposal Area, and the former Tar Settling Ponds / adjacent low areas appear to be the primary source areas.

In addition to oil, a highly viscous to semi-solid tar was identified during the RI in a number of borings installed throughout the southeastern portion of the site, corresponding to the location of the former tar ponds and the adjacent low areas where tar and oil was historically discharged. Additionally, isolated areas of tar were identified at the location of the former naphthalene plant and in the vicinity of the former spent oxide storage area (incorporated into fill).

Carbon pitch solids, a dry black granular or powdery material derived from the coal or petroleum coking process, have been identified in site soils. Carbon pitch (e.g., lampblack or pencil pitch) has been identified within fill located throughout much of the southeastern portion of the site (former tar pond/adjacent low area), extending west to the vicinity of the current KI pencil pitch storage structure/former pitch pans. Additionally, carbon pitch was identified within fill at the northern / northwestern portions of the site (former spent oxide storage area and former office area).

The following maximum concentrations of COPCs have been identified in soil (all depths) at the site:

COPC in Soil-Sitewide	**Maximum (mg/kg)**
Benzene	360
Ethylbenzene	140
Xylenes	289
Acenaphthene	9,210
Acenaphthylene	3,480
Benzo(a)anthracene	2,450
Benzo(b)fluoranthene	1,760
Benzo(g,h,i)perylene	2,543
Benzo(k)fluoranthene	1,700
Benzo(a)pyrene	2,780
Chrysene	2,880
Dibenz(a,h)anthracene	500
Fluoranthene	8,480
Fluorene	4,530
Indeno(1,2,3-cd)pyrene	1,800
Naphthalene	20,700
Phenanthrene	15,500
Cyanide-Total	518
Chromium	70.9
Zinc	226

10.1.2. Riverbank Samples

☒ Yes ☐ No

In November 1998, eleven surface soil samples were collected at areas of exposed soil along the embankment adjacent to the Willamette River. Samples were collected at approximate 200-foot intervals, as well as from areas where discoloration was identified.

The following maximum concentrations of COPCs have been identified in surficial embankment soils at the site:

COPC in Soil-Riverbank	**Maximum (mg/kg)**
Benzene	Not analyzed
Ethylbenzene	Not analyzed
Xylenes	Not analyzed
Acenaphthene	0.64
Acenaphthylene	11.1
Benzo(a)anthracene	21.9
Benzo(b)fluoranthene	60.9
Benzo(g,h,i)perylene	69.9
Benzo(k)fluoranthene	17.0
Benzo(a)pyrene	69.1
Chrysene	29.7
Dibenz(a,h)anthracene	9.4
Fluoranthene	16.1
Fluorene	0.61
Indeno(1,2,3-cd)pyrene	47.3
Naphthalene	5.0
Phenanthrene	7.0
Cyanide-Total	56
Chromium	Not analyzed
Zinc	Not analyzed

10.1.3. Summary

With regard to potentially complete pathways to the river, contaminated fill along portions of the river embankment prone to erosion, as well as overland transport of impacted surficial soils along the ditch leading to the stormwater outfall located within the former tar pond area, and the KI stormwater outfall located at the southern corner of the site, may be potential current sources of impact to in-water media.

10.2. Groundwater

10.2.1. Groundwater Investigations ☒ Yes ☐ No

NW Natural has conducted groundwater investigation and quarterly monitoring activities at the site since 1996, with 24 groundwater monitoring wells screened within the Surficial Fill or Alluvial WBZs, presently on site.

10.2.2. NAPL (Historic & Current) ☒ Yes ☐ No

DNAPL has been identified within three Surficial Fill WBZ wells, all located at the central portion of the site approximately 350 feet to 750 feet upland from the Willamette River shoreline. Thickness of DNAPL accumulation in these wells ranges from approximately 0 to 2 feet at southern locations (MW-10-25 and MW-11-32), and 6 to 10 feet at the northern location (MW-6-32). DNAPL has not been identified in any well adjacent to the Willamette River at the Gasco site, although further evaluation of the presence of DNAPL adjacent to the river to the east and north of the former tar pond area is scheduled for summer 2004.

Pilot-scale DNAPL extraction activities were conducted at the site in 1999 to evaluate the recoverability of DNAPL from the wells. Results of pilot-scale testing indicated DNAPL recovery from the MW-6-32 well location is feasible, with recovery having been implemented in 2000. As of December 2003, approximately 500 gallons of DNAPL have been recovered at this well location.

10.2.3. Dissolved Contaminant Plumes ☒ Yes ☐ No

A dissolved plume, consisting of constituents associated with oil tar and coal tar (PAHs), as well as oil tar distillates (e.g., BTEX), is present in the Surficial Fill WBZ and the shallow to intermediate-depth Alluvial WBZ beneath portions of the site. Investigation of the lower Alluvial WBZ and the Confined Basalt Aquifer determined releases at the site have not affected these areas.

Plume Characterization Status ☐ Complete ☐ Incomplete

On-site plume characterization activities are nearly complete. Supplemental soil and groundwater quality investigation activities related to contaminant distribution adjacent to the Willamette River in the southeastern portion of the site were initiated in June 2004, consisting of collection of soil and groundwater quality data from temporary well points, to be followed with installation of additional monitoring wells.

10.2.4. Plume Extent

Min/Max Detections (Current situation)

Using the most recent groundwater quality data available for the Gasco site (non-NAPL-bearing wells), which depending on the well location, ranges in date from March 2001 to January 2004, the minimum and maximum groundwater plume detections at the site data include:

	Minimum	Maximum	Detection Limits (Units)
Benzene	<0.5	44,000 (MW-15-50)	0.1 μg/L
Benzo(a)anthracene	<0.1	8.97 (MW-8-29)	0.1 μg/L
Benzo(b)fluoranthene	<0.1	6.40 (MW-8-29)	0.1 μg/L
Benzo(k)fluroanthene	<0.1	5.16 (MW-8-29)	0.1 μg/L
Benzo(a)pyrene	<0.1	10 (MW-8-29)	0.1 μg/L
Chrysene	<0.1	10.9 (MW-8-29)	0.1 μg/L
Dibenz(a,h)anthracene	<0.1	1.93 (MW-8-29)	0.1 μg/L
Indeno(1,2,3-cd)pyrene	<0.1	5.76 (MW-8-29)	0.1 μg/L
Acenaphthene	<0.1	173 (MW-8-29)	0.1 μg/L
Acenapthylene	<0.1	61 (MW-8-56)	0.1 μg/L
Anthracene	<0.1	22.26 (MW-8-29)	0.1 μg/L
Benzo(g,h,i)perylene	<0.1	6.48 (MW-8-29)	0.1 μg/L
Fluoranthene	<0.1	31.2 (MW-8-29)	0.1 μg/L
Fluorene	<0.1	48 (MW-13-30)	0.1 μg/L
Naphthalene	<0.1	7,400 (MW-8-56)	0.1 μg/L
Phenanthrene	<0.1	151 (MW-8-29)	0.1 μg/L
Pyrene	<0.1	36 (MW-8-29)	0.1 μg/L
Cyanide-Total	<0.04	1.3 (MW-4-57)	*0.04* μg/L
Arsenic - Total	<5.0	44.0 (MW-14-110)	*5.0* μg/L
Chromium - Total	<1.0	61 (MW-5-32)	*1.0* μg/L
Copper - Total	<3.0	65.1 (MW-5-32)	*3.0* μg/L
Lead - Total	<5.0	52.4 (MW-5-32)	*5.0* μg/L
Nickel - Total	<5.0	191 (MW-3-26)	*5.0* μg/L
Zinc - Total	<5.0	210 (MW-8-29)	*5.0* μg/L

Current Plume Data (December 2003/January 2004 data set)

The estimated lateral on-site extent of groundwater contaminant plumes for key indicator groundwater COIs (benzene and naphthalene) are depicted on Figures 2 and 3 (based on Supplemental Figures 11 through 14). Supplemental Figures 11-14 show iso-concentration plume maps are provided for benzene and naphthalene, for both the Surficial Fill WBZ and for the Alluvial WBZ. The December 2003/January 2004 data set (HAI, 2004) for the Gasco site was used in preparation of the referenced plume maps.

Preferential Pathways

No current preferential groundwater contaminant transport pathways between the upland portion of the site and the Willamette River have been identified at the site.

Downgradient Plume Monitoring Points (min/max detections)

The down-gradient extent of the contaminant plume at the Gasco site is monitored by 12 monitoring wells installed within the Surficial Fill WBZ and the Alluvial WBZ at five locations near the top of the embankment adjacent to the Willamette River. A summary of the most recent minimum and maximum identified concentrations of COPCs in groundwater at these down-gradient locations (as of January 2004) is provided below.

	Minimum	Maximum	Detection Limits (Units)
Benzene	<0.5	17,000 (MW-4-57)	0.1 μg/L
Benzo(a)anthracene	<0.1	2.31 (MW-1-22)	0.1 μg/L
Benzo(b)fluoranthene	<0.1	1.95 (MW-1-22)	0.1 μg/L
Benzo(k)fluroanthene	<0.1	1.42 (MW-1-22)	0.1 μg/L
Benzo(a)pyrene	<0.1	2.22 (MW-1-22)	0.1 μg/L
Chrysene	<0.1	3.03 (MW-1-22)	0.1 μg/L
Dibenz(a,h)anthracene	<0.1	0.66 (MW-1-22)	0.1 μg/L
Indeno(1,2,3-cd)pyrene	<0.1	1.77 (MW-1-22)	0.1 μg/L
Acenaphthene	<0.1	38. (MW-3-56)	0.1 μg/L
Acenapthylene	<0.1	0.82 (MW-4-35)	0.1 μg/L
Anthracene	<0.1	5.8 (MW-3-56)	0.1 μg/L
Benzo(g,h,i)perylene	<0.1	2.08 (MW-3-26)	0.1 μg/L
Fluoranthene	<0.1	8. (MW-3-56)	0.1 μg/L
Fluorene	<0.1	12 (MW-3-56)	0.1 μg/L
Naphthalene	<0.1	5,600 (MW-5-100)	0.1 μg/L
Phenanthrene	<0.1	18 (MW-3-56)	0.1 μg/L
Pyrene	<0.1	8.23 (MW-1-22)	0.1 μg/L
Cyanide-Total	<0.04	1.3 (MW-4-57)	*0.04* μg/L
Arsenic - Total	<5.0	40. (MW-4-101)	*5.0* μg/L
Chromium - Total	<1.0	61 (MW-5-32)	*1.0* μg/L
Copper - Total	<3.0	65.1 (MW-5-32)	*3.0* μg/L
Lead - Total	<5.0	52.4 (MW-5-32)	*5.0* μg/L
Nickel - Total	<5.0	191 (MW-3-26)	*5.0* μg/L
Zinc - Total	<5.0	117 (MW-5-32)	*5.0* μg/L

Visual Seep Sample Data ☐ Yes ☒ No

Seeps not sampled.

Nearshore Porewater Data ☐ Yes ☒ No

Porewater not sampled.

Groundwater Plume Temporal Trend

To date, no groundwater remedial activities have been implemented at the site to allow comparison of pre- and post-remedial concentrations. The existing data set indicates temporal fluctuations in contaminant concentrations within the plume related to water level changes and other factors such as laboratory and sampling-induced variability.

10.2.5. Summary

Based on continuous water level monitoring, there appears to be limited groundwater/surface water interconnectivity between the Surficial Fill WBZ and the Willamette River. Further, contaminant concentrations within the Surficial Fill WBZ show marked decline between upland source areas and down-gradient monitoring points located adjacent to the Willamette River (HAI, 1998).

The greatest groundwater quality impacts at the site adjacent to the Willamette River have been identified in the upper alluvial WBZ near the southeastern corner of the property (i.e., former Tar Pond Area). Groundwater flow direction data, as well as results of continuous water level monitoring, suggest interconnectivity between the upper Alluvial WBZ and the Willamette River (HAI, 1998). Lack of a strong vertical gradient within the Alluvial WBZ adjacent to the river suggests the contaminant plume would intersect Willamette River sediments across elevations similar to those where the plume is identified in vicinity of the shoreline (Anchor, 2001b).

No zones of preferential contaminant transport within groundwater between upland portions of the site and the Willamette River have been identified at the site.

10.3. Surface Water

10.3.1. Surface Water Investigation ☒ Yes ☐ No

Upland area surface water sampling activities were conducted at the Gasco site on January 30, 1996 (HAI, 1998). These activities included the collection of surface water samples at two locations within the on-site drainage ditch that carries stormwater and non-contact cooling water to the outfall located near the southeastern portion of the site. The source for water within the drainage ditch is non-contact cooling water from the LNG operations, stormwater runoff from a majority of the Gasco Site (with exception of the KI Lease Area), as well as any groundwater seepage that may be removed from sumps installed within the FAMM storage tank containment basins. Results of the sample collected within the drainage ditch from the sample location closest to the outfall (sample SW-04) to the Willamette River are summarized below:

	Concentration (μg/L)
Benzene	6.2
Benzo(a)anthracene	0.11
Benzo(b)fluoranthene	0.18
Benzo(k)fluroanthene	<0.10
Benzo(a)pyrene	0.12
Chrysene	0.16
Dibenz(a,h)anthracene	<0.10
Indeno(1,2,3-cd)pyrene	0.12
Acenaphthene	1.1
Acenapthylene	0.31
Anthracene	0.16
Benzo(g,h,i)perylene	0.17
Fluoranthene	0.32
Fluorene	0.44
Naphthalene	18
Phenanthrene	1.0
Pyrene	0.28
Cyanide-Total	not analyzed
Arsenic - Total	not analyzed
Chromium - Total	not analyzed

Copper - Total	not analyzed
Lead - Dissolved	<5.0
Nickel - Total	not analyzed
Zinc - Total	not analyzed

10.3.2. General or Individual Stormwater Permit (Current or Past) ☐ Yes ☒ No

NW Natural does not require a General or Individual Stormwater Permit for its operations.

Note: FAMM and Koppers Industries, Inc. do have stormwater permits for their operational areas, which are not summarized herein at this time.

Do other non-stormwater wastes discharge to the system? ☐ Yes ☒ No

10.3.3. Stormwater Data ☐ Yes ☒ No

NW Natural is not required to sample its stormwater discharges based on its operational activities at the site. Data regarding FAMM and Koppers Industries, Inc. stormwater discharges are reported by these parties to DEQ in accordance with their permit requirements. Koppers, Inc. and FAMM-related stormwater discharge data are not summarized within this CSM update.

10.3.4. Catch Basin Solids Data ☐ Yes ☒ No

Catch basin solids at the site have not been sampled as part of RI activities at the site.

10.3.5. Wastewater Permit ☒ Yes ☐ No

NW Natural has the following wastewater permits for LNG-related activities at the subject property:

Permit Type	Permit Number	Start Date	Outfalls	Volumes	Parameters/Frequency
GEN15A NPDES	10534	3/2/1994	To river	<50,000 gpd	temp, residual chlorine, pH / monthly
GEN01	62231	10/26/1981	To river	Not available at time of update	PAHs, BTEX, Dx, Gx / quarterly

10.3.6. Wastewater Data ☒ Yes ☐ No

NW Natural's wastewater discharges are monitored according to requirements of the above-identified permits, with all data available in DEQ files.

10.3.7. Summary

NW Natural has one combined stormwater/wastewater outfall that discharges to the embankment above the Willamette River at the subject property. Low levels of benzene and certain PAHs have been identified in surface water within the drainage ditch that carries stormwater and non-contact cooling water to the NPDES-permitted outfall to the Willamette River (Section 10.3.1). The water in the drainage ditch includes stormwater runoff from a majority of the Gasco site, with the exception of the KI lease area. Stormwater from the KI lease area is collected and discharged through KI's NPDES-permitted outfall that drains to an open ditch located at the southern corner of the property, which ultimately leads to City of Portland Outfall 22C, located on the Willamette River immediately downstream of the Burlington Northern Santa Fe Railroad Company bridge.

10.4. Sediment

10.4.1. River Sediment Data

☒ Yes ☐ No

Several studies have collected sediment surface samples and cores between the site shoreline and the edge of the navigation channel since in 1996 (USACE 1996, Battelle 2002, HAI 1998, Weston 1998, Anchor 2001b, and Integral in prep.). NW Natural also performed an investigation in 2001 to delineate the extent of a tar deposit on the sediment. The delineation of the tar deposit was based on direct observations by divers, and it did not include collecting additional samples.

In all, 44 sediment samples were collected from 21 locations. Sediment sampling locations are shown on Figure 1 and samples are summarized in Table 2. The limits of the tar body on surface sediments is shown in Supplemental Figure xx (no figure number).

In surface sediments (top 30 cm), PAHs, heavy oils, dibenzofuran, cyanide, and metals were detected in all or a large majority of samples where these chemicals were analyzed. Consistent with the presence of dispersed tars and oils in some locations (see core log descriptions below), PAHs were found in the highest concentrations, with LPAHs ranging from 8.57 mg/kg to 56,500 mg/kg and HPAHs ranging from 31.5 mg/kg to 12,268 mg/kg. Dibenzofuran was detected at substantially lower concentrations between 0.53 and 99 mg/kg. Cyanide was detected at concentrations ranging from 0.3 to 2.2 mg/kg. In contrast, concentrations of heavy metals such as cadmium, copper, lead, mercury, nickel, silver, and zinc were similar to those found throughout Portland Harbor (see Table 2). BTEX compounds were also occasionally detected in surface sediment samples. Where these chemicals were detected in a majority of samples, these detections were generally very low level. For example, xylenes and ethylbenzene were detected in a number of samples, but the median concentrations were less than 0.2 ug/kg. In some instances, higher concentrations were found for BTEX with maximums of: benzene at 22 mg/kg, toluene at 4.2 mg/kg, ethylbenzene at 10 mg/kg, and total xylenes at 18 mg/kg. Other chemicals were also occasionally detected in surface sediment samples (see Table 2).

In subsurface sediments (below 30 cm), PAHs, dibenzofuran, cyanide, metals, and some BTEX compounds were detected in all or a large majority of the samples where these chemicals were analyzed. PAHs were most notable, with LPAHs in the 0.45 to 4299 mg/kg range and HPAHs in the 1.75 to 2,063 mg/kg range. Dibenzofuran was detected at lower concentrations ranging from 0.77 to 2.3 mg/kg. Cyanide was detected at concentration from 0.2 to 5.4 mg/kg. Similar to surface sediments, concentrations of metals such as cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc were similar to those found throughout Portland Harbor. BTEX compounds other than toluene were detected frequently in subsurface sediments with maximums of: benzene at 1.8 mg/kg, ethylbenzene at 6.2 mg/kg, and xylenes 6 mg/kg.

The descriptive logs from the 12 sediment cores in the study area were reviewed. The cores were advanced to between 5.0 and 12.2 feet into the sediment, with an average recovery of 9.5 feet. Nearly all of the sediment descriptions at all depths ranged from silt to coarse sand, with isolated pockets of gravel noted. The deepest materials tend to be marginally coarser, with sandy silts and silty sands overlying coarser sand, although the deepest materials were silts at some locations. Visual indications of dispersed tar and or oil related materials were observed at several locations within most of the nearshore cores.

The sediment trends analysis performed by GeoSea Consulting Ltd (2001) indicates that the depositional environment near the Gasco site is in dynamic equilibrium, with some specific locations undefined. Adjacent to the Gasco site, sediments are deposited and scoured in sequence depending on river conditions. The bathymetry adjacent to the site has been fairly stable, reflecting human intervention (construction) more than significant erosion or deposition. The bathymetric surveys performed in January 2002 and May 2003 support the conclusion that the shoreline adjacent to the site is in dynamic equilibrium. The comparison of the two surveys shows small amounts (as much as 1 to 2 feet) of deposition along much of the shoreline adjacent to the Gasco site and some smaller areas of similar degrees (up to 1 to 2 feet) of erosion adjacent to the site.

10.4.2. Summary

See Final CSM Update.

11. CLEANUP HISTORY AND SOURCE CONTROL MEASURES

11.1. Soil Cleanup/Source Control

No soil cleanup or source control activities have been conducted at the site to date.

11.2. Groundwater Cleanup/Source Control

Groundwater from the Surficial Fill WBZ that seeps into the LNG containment basin is removed and treated in an on-site carbon adsorption system prior to discharge to the Willamette River via a permitted wastewater treatment system. Although the objective of this recovery and treatment system is not source control or remediation-based, groundwater is removed and treated from the central portion of the site (e.g., well MW-10-26 area), a location corresponding to some of the greatest contaminant concentrations within the Surficial Fill WBZ.

11.3. Other

DNAPL extraction was initiated as an interim remedial measure in 2000 at one monitoring well location (MW-6-32), where pilot testing indicated the feasibility of removal. As of December 2003, nearly 500 gallons of DNAPL had been recovered at this well location.

11.4. Potential for Recontamination from Upland Sources

See Final CSM Update.

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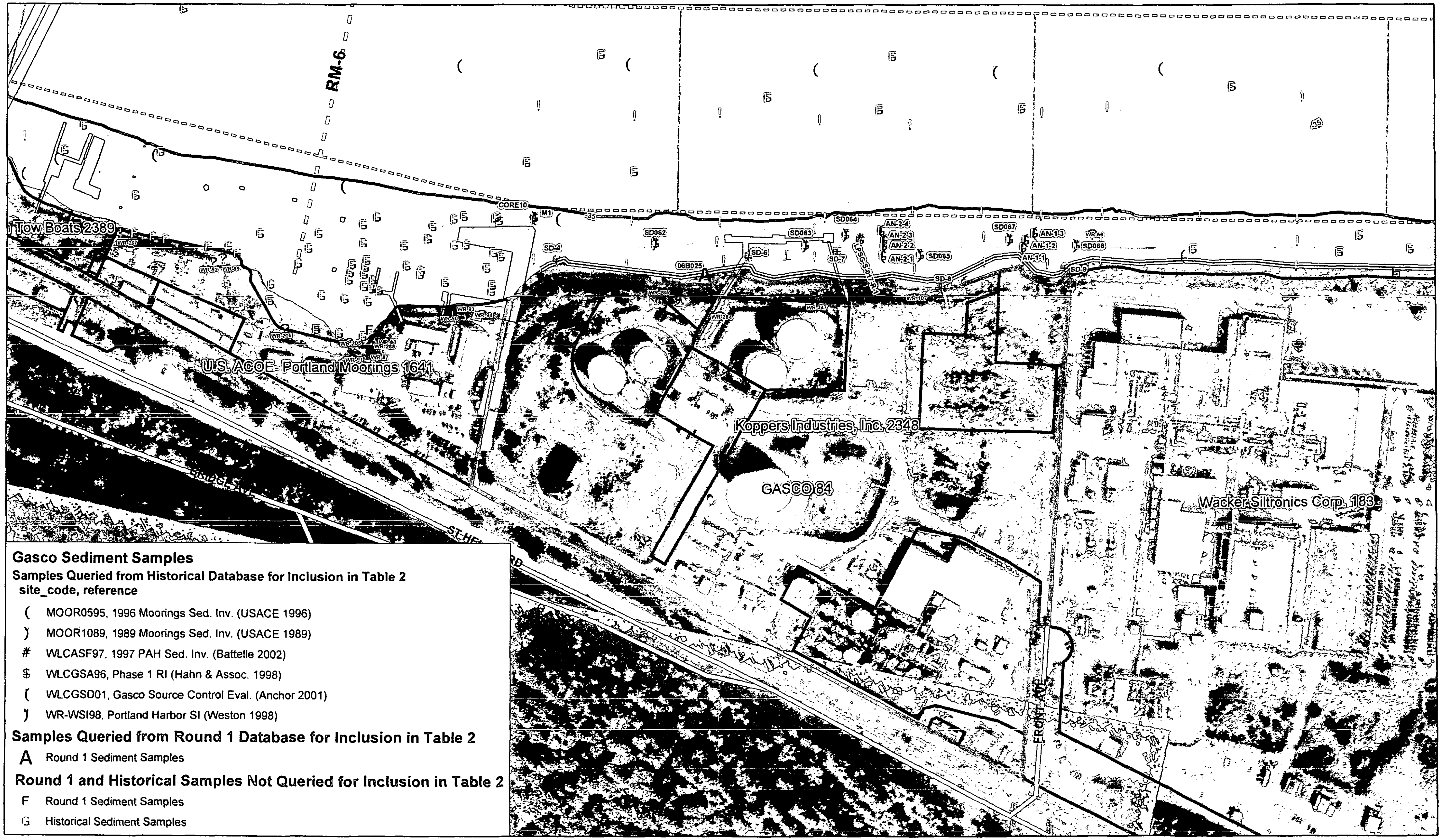
Figures:

Tables:

Supplemental Figures:

FIGURES



integral consulting inc.

LWG Lower Willamette Group

Map Document: (C:\GIS\Projects\Portland_Harbor\ LWG-Map-Projects\Conseptual_Site_Model\Sample_Locations.mxd)
Plot Date: 07/26/2004
Areal Photo Date: October 2001.
Base Map features from Portland Metro's RLIS.

The City of Portland Outfall mapping information is based on available records; no warranty, expressed or implied, is provided as to the completeness or accuracy of the information. Current layer updated June 2004.

City Outfalls
City Outfalls (Abandoned)
Outfalls (private)
Seep Photo Location (Not location of actual Seep)

River Miles
Navigation Channel
-35ft. Contour (NAVD 88)
Docks & In-water Structures
Selected ECSI Site Property Boundary

Human Use Areas
Dockside Worker
Recreational Beach Use
Transient

LWG Round 2 Proposed Sediment Samples
Surface Sample Only
Core & Surface Sample

0 150 300 600 Feet

DRAFT

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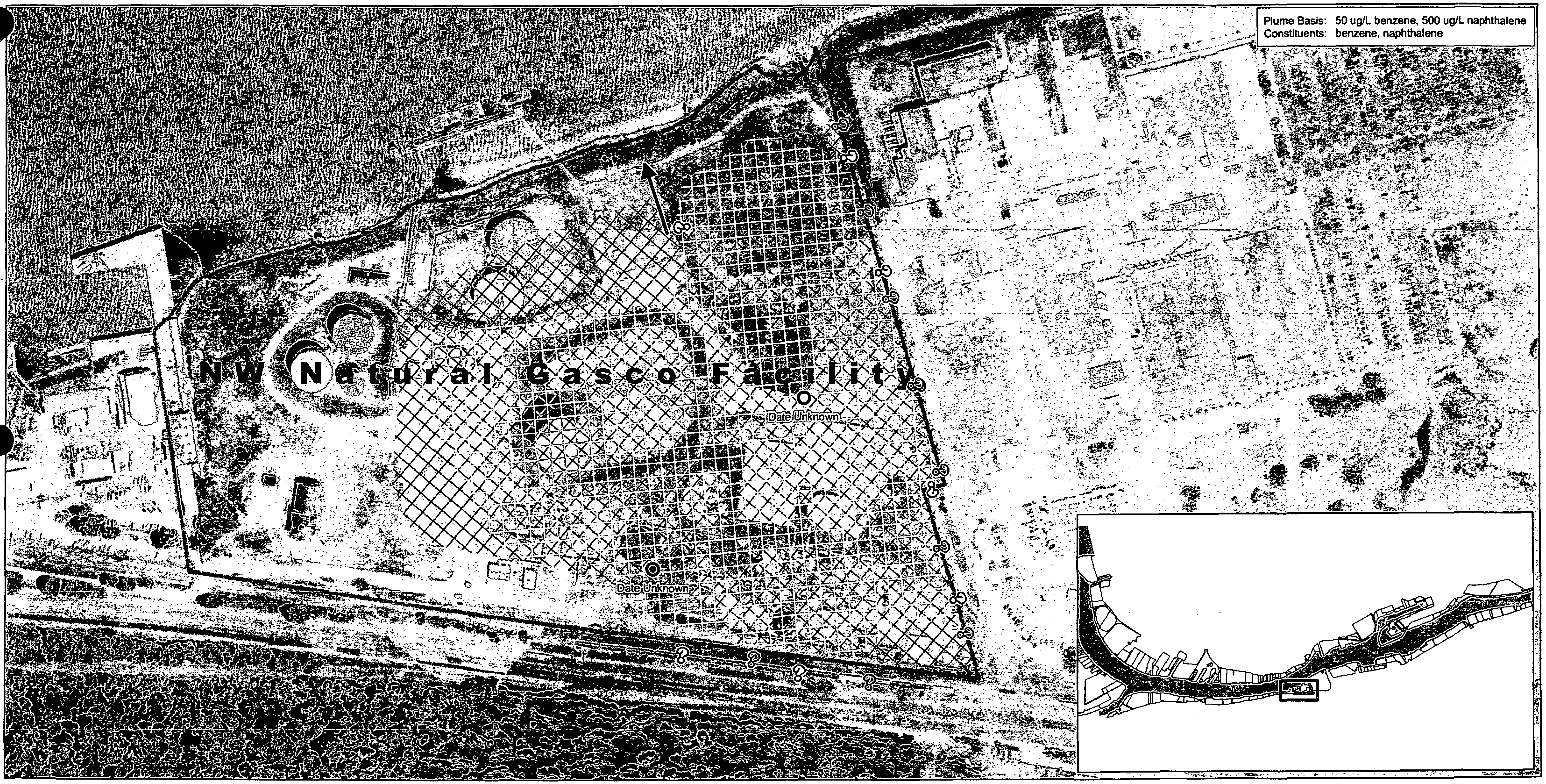
Figure 1
Portland Harbor
Conceptual Site Model
GASCO
ECSI 84

DRAFT



Groundwater Solutions Inc.

LWG
LOWER WILLAMETTE GROUP

0 200 400 Feet

FEATURE SOURCES:
Transportation, Water, Property, Zoning or Boundaries: Metro RLIS.
ECSI site locations were summarized in December, 2002
and January, 2003 from ODEQ ECSI files.

Map Creation Date: August 11, 2004

File Name: Fig3_GascoNW_SummaryMap.mxd

LEGEND

Site Boundary

Maximum Detection Location

General Groundwater Flow

Contaminant Type

PAH

VOCs

Extent of Impacted Groundwater

For details, refer to plume interpretation table in CSM document.

Single or isolated detection of COI's. Extent or continuity of impacted groundwater between sample points is uncertain. Color based on contaminant type.

Estimated extent of impacted groundwater area. Color based on contaminant type.

Figure 2
Portland Harbor RI/FS
NW Natural Gasco Facility
Extent of Impacted Groundwater - Shallow Zone
Upland Groundwater Quality Overview

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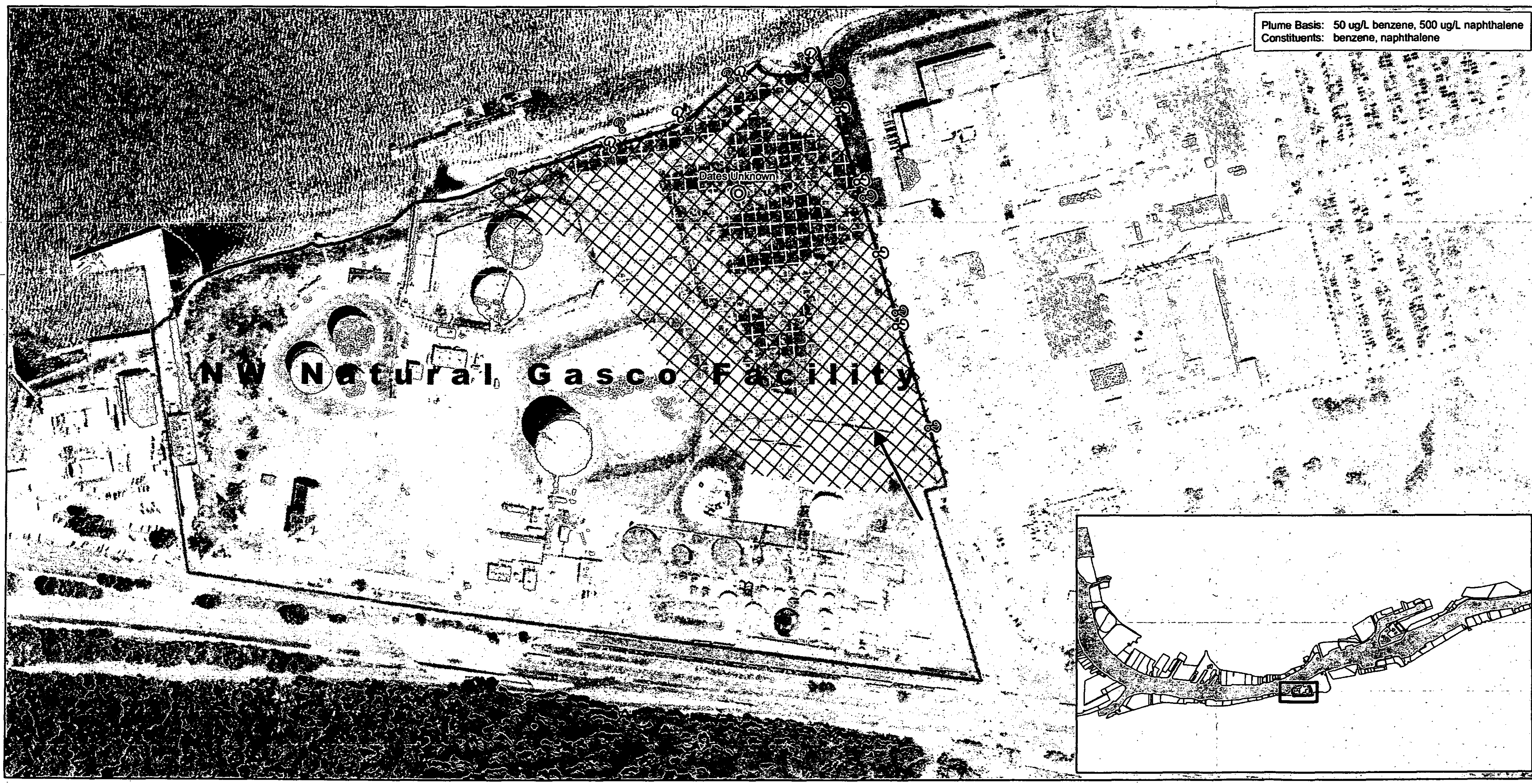

Groundwater Solutions Inc.

LWG
LOWER WILLAMETTE GROUP

0 200 400 Feet

FEATURE SOURCES:
Transportation, Water, Property, Zoning or Boundaries: Metro RLIS.
ECSI site locations were summarized in December, 2002 and January, 2003 from ODEQ ECSI files.

Map Creation Date: August 16, 2004

File Name: Fig4_GascoNW_SummaryMap.mxd

LEGEND

Site Boundary

Maximum Detection Location

General Groundwater Flow

Contaminant Type

PAH

VOCs

Extent of Impacted Groundwater

For details, refer to plume interpretation table in CSM document.

Single or isolated detection of COI's. Extent or continuity of impacted groundwater between sample points is uncertain. Color based on contaminant type.

Estimated extent of impacted groundwater area. Color based on contaminant type.

Figure 3
Portland Harbor RI/FS
NW Natural Gasco Facility
Extent of Impacted Groundwater - Intermediate Zone
Upland Groundwater Quality Overview

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TABLES

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LWG
Lower Willamette Group

Gasco, ECSI #84

Table 1. Potential Sources and Transport Pathways Assessment

Last Updated: September 15, 2004

Potential Sources	Media Impacted					COIs																		Potential Complete Pathway				
						TPH			VOCs																			
Description of Potential Source	Surface Soil	Subsurface Soil	Groundwater	Catch Basin Solids	River Sediment	Gasoline-Range	Diesel - Range	Heavier - Range	Petroleum-Related (e.g. BTEX)	VOCs	Chlorinated VOCs	SVOCs	PAHs	Phthalates	Phenolics	Metals	PCBs	Herbicides and Pesticides	Dioxins/Furans	Butyltins	*Cyanide*	*(Others -List)*	*(Others -List)*	Overland Transport	Groundwater	Direct Discharge - Overwater	Direct Discharge - Storm/Wastewater	Riverbank Erosion
Upland Areas																												
A																												
Former Retort Area		√	√						√				√												√			
Former Tar Processing Area		√	√						√				√												√			
Former Light Oil Plant/Koppers Co. Plant/Current KI Tank Farm		√	√						√				√												√			
Former Naphthalene Plant		√	√						√				√												√			
Former Coke Oven Area		√	√						√				√												√			
Former Pitch Plant/Tar Loading Area		√	√						√				√												√			
Former Tar Settling Ponds		√	√		?				√				√												√			
Former Koppers Land Disposal Area		√	√						√				√												√			
Former Koppers Co./ Current KI Pencil Pitch Storage Area	√			?	?								√															
Former Spent Oxide Storage Area		√	√						√				√			√					√				√			√
MGP By-Product Incorporation into Fill	√	√	√	?	?				√				√			√					√				√		√	√
Overwater Areas																												
B																												
Releases during product transfer from vessels					?		√	√	√				√													√		
Other Areas/Other Issues																												
Historic direct discharge of tar and oil to river					√				√				√															

Notes:

[1] All information provided in this table is referenced in the site summaries. If information is not available or inconclusive, a ? may be used, as appropriate. No new information is provided in this table.

✓ = Source, COI are present or current or historic pathway is determined to be complete or potentially complete.

? = There is not enough information to determine if source or COI is present or if pathway is complete.

Blank = Source, COI and historic and current pathways have been investigated and shown to be not present or incomplete.

UST Underground storage tank
AST Above-ground storage tank
TPH Total petroleum hydrocarbons
VOCs Volatile organic compounds
SVOCs Semivolatile organic compounds
PAHs Polycyclic aromatic hydrocarbons
BTEX Benzene, toluene, ethylbenzene, and xylenes
PCBs Polychorinated biphenols

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Aroclor 1016 (ug/kg)	1	0	0						3.9 U	3.9 U	3.9	3.9 U	3.9 U
surface	Aroclor 1242 (ug/kg)	1	0	0						3.9 U	3.9 U	3.9	3.9 U	3.9 U
surface	Aroclor 1248 (ug/kg)	1	0	0						3.9 U	3.9 U	3.9	3.9 U	3.9 U
surface	Aroclor 1254 (ug/kg)	1	1	100	29	29	29	29	29	29	29	29	29	29
surface	Aroclor 1260 (ug/kg)	1	0	0						25 U	25 U	25	25 U	25 U
surface	Aroclor 1221 (ug/kg)	1	0	0						7.7 U	7.7 U	7.7	7.7 U	7.7 U
surface	Aroclor 1232 (ug/kg)	1	0	0						3.9 U	3.9 U	3.9	3.9 U	3.9 U
surface	Polychlorinated biphenyls (ug/kg)	1	1	100	29	29	29	29	29	29	29	29	29	29
surface	Dibutyltin ion (ug/l)	1	0	0						0.06 U	0.06 U	0.06	0.06 U	0.06 U
surface	Tributyltin ion (ug/l)	1	1	100	0.18 J	0.18 J	0.18	0.18 J	0.18 J	0.18 J	0.18 J	0.18	0.18 J	0.18 J
surface	Tetrabutyltin (ug/l)	1	0	0						0.02 U	0.02 U	0.02	0.02 U	0.02 U
surface	Total solids (percent)	9	9	100	43.9	83.4	58.5	54.2	76.5	43.9	83.4	58.5	54.2	76.5
surface	Total organic carbon (percent)	21	21	100	0.54	12	3.29	2.8	5.35	0.54	12	3.29	2.8	5.35
surface	Total volatile solids (percent)	1	1	100	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3
surface	Cyanide (mg/kg)	7	7	100	0.3 J	2.2	1.09	1.1	1.5	0.3 J	2.2	1.09	1.1	1.5
surface	Gravel (percent)	8	8	100	0.09	22.9	5.03	0.89	13.8	0.09	22.9	5.03	0.89	13.8
surface	Sand (percent)	7	7	100	15.51	29.49	24.2	25.58	26.93	15.51	29.49	24.2	25.58	26.93
surface	Very coarse sand (percent)	2	2	100	3	5.7	4.35	3	3	3	5.7	4.35	3	3
surface	Coarse sand (percent)	2	2	100	4.6	10.4	7.5	4.6	4.6	4.6	10.4	7.5	4.6	4.6
surface	Medium sand (percent)	2	2	100	3.7	44.1	23.9	3.7	3.7	3.7	44.1	23.9	3.7	3.7
surface	Fine sand (percent)	2	2	100	2.2	24.5	13.4	2.2	2.2	2.2	24.5	13.4	2.2	2.2
surface	Very fine sand (percent)	2	2	100	0.91	7.4	4.16	0.91	0.91	0.91	7.4	4.16	0.91	0.91
surface	Fines (percent)	7	7	100	70.3	83.54	75.3	74.32	77.9	70.3	83.54	75.3	74.32	77.9
surface	Silt (percent)	7	7	100	59.54	71.4	64.4	62.39	71.24	59.54	71.4	64.4	62.39	71.24
surface	Coarse silt (percent)	2	1	50	22.2	22.2	22.2	22.2	22.2	0.01 U	22.2	11.1	0.01 U	0.01 U
surface	Medium silt (percent)	2	2	100	0.23	13	6.62	0.23	0.23	0.23	13	6.62	0.23	0.23
surface	Fine silt (percent)	2	2	100	0.19	8	4.1	0.19	0.19	0.19	8	4.1	0.19	0.19
surface	Very fine silt (percent)	2	2	100	0.1	4.9	2.5	0.1	0.1	0.1	4.9	2.5	0.1	0.1
surface	Clay (percent)	7	7	100	4	13.82	11	11.73	12.66	4	13.82	11	11.73	12.66
surface	8-9 Phi clay (percent)	2	2	100	0.08	2.4	1.24	0.08	0.08	0.08	2.4	1.24	0.08	0.08
surface	9-10 Phi clay (percent)	2	2	100	0.06	2.1	1.08	0.06	0.06	0.06	2.1	1.08	0.06	0.06
surface	>10 Phi clay (percent)	2	2	100	0.15	3.6	1.88	0.15	0.15	0.15	3.6	1.88	0.15	0.15
surface	Mean grain size (percent)	1	1	100	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041
surface	Median grain size (percent)	1	1	100	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
surface	Dalapon (ug/kg)	1	0	0						16 U	16 U	16	16 U	16 U
surface	Dicamba (ug/kg)	1	0	0						3.3 UJ	3.3 UJ	3.3	3.3 UJ	3.3 UJ
surface	MCPA (ug/kg)	1	0	0						3300 U	3300 U	3300	3300 U	3300 U
surface	Dichloroprop (ug/kg)	1	0	0						6.5 UJ	6.5 UJ	6.5	6.5 UJ	6.5 UJ
surface	2,4-D (ug/kg)	1	0	0						6.5 UJ	6.5 UJ	6.5	6.5 UJ	6.5 UJ
surface	Silvex (ug/kg)	1	0	0						1.6 UJ	1.6 UJ	1.6	1.6 UJ	1.6 UJ
surface	2,4,5-T (ug/kg)	1	0	0						5 U	5 U	5	5 U	5 U
surface	2,4-DB (ug/kg)	1	0	0						32 U	32 U	32	32 U	32 U
surface	Dinoseb (ug/kg)	1	0	0						3.3 U	3.3 U	3.3	3.3 U	3.3 U
surface	MCPP (ug/kg)	1	0	0						3300 U	3300 U	3300	3300 U	3300 U
surface	Aluminum (mg/kg)	7	7	100	15700	42600	36200	39000	41300	15700	42600	36200	39000	41300
surface	Aluminum (mg/l)	1	1	100	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66
surface	Antimony (mg/kg)	1	1	100	0.2 J	0.2 J	0.2	0.2 J	0.2 J	0.2 J	0.2 J	0.2	0.2 J	0.2 J
surface	Antimony (mg/l)	1	0	0						0.05 U	0.05 U	0.05	0.05 U	0.05 U
surface	Arsenic (mg/kg)	14	8	57.1	2.3	5.1	3.69	3.5	4.4	2.3	6 U	4.32	4.4	5.1

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Arsenic (mg/l)	1	1	100	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
surface	Cadmium (mg/kg)	7	7	100	0.06	0.5	0.38	0.4	0.5	0.06	0.5	0.38	0.4	0.5
surface	Cadmium (mg/l)	1	0	0						0.002 U	0.002 U	0.002	0.002 U	0.002 U
surface	Chromium (mg/kg)	14	14	100	11.6 J	41.7	32.5	33.6	40.8	11.6 J	41.7	32.5	33.6	40.8
surface	Chromium (mg/l)	1	0	0						0.005 U	0.005 U	0.005	0.005 U	0.005 U
surface	Copper (mg/kg)	14	14	100	21	55.9	41.6	45.2	51.1	21	55.9	41.6	45.2	51.1
surface	Copper (mg/l)	1	1	100	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024
surface	Lead (mg/kg)	20	20	100	11 J	56.8	28.8	27	50	11 J	56.8	28.8	27	50
surface	Lead (mg/l)	1	1	100	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
surface	Manganese (mg/kg)	6	6	100	624	840	705	681	750	624	840	705	681	750
surface	Manganese (mg/l)	1	1	100	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
surface	Mercury (mg/kg)	7	6	85.7	0.06	0.24	0.138	0.08	0.2	0.05 U	0.24	0.126	0.08	0.2
surface	Mercury (mg/l)	1	0	0						0.0001 U	0.0001 U	0.0001	0.0001 U	0.0001 U
surface	Nickel (mg/kg)	14	14	100	12 J	69	31.4	30	37	12 J	69	31.4	30	37
surface	Nickel (mg/l)	1	0	0						0.01 U	0.01 U	0.01	0.01 U	0.01 U
surface	Selenium (mg/kg)	7	6	85.7	11	17	13.3	13	14	0.2 U	17	11.5	13	14
surface	Selenium (mg/l)	1	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Silver (mg/kg)	7	6	85.7	1	1.3	1.18	1.2	1.2	0.02 U	1.3	1.02	1.2	1.2
surface	Silver (mg/l)	1	1	100	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
surface	Thallium (mg/kg)	6	3	50	5	8	6	5	5	5	8	5.5	5 U	5
surface	Thallium (mg/l)	1	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Zinc (mg/kg)	14	14	100	70.5 J	281 J	136	125	185	70.5 J	281 J	136	125	185
surface	Zinc (mg/l)	1	1	100	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
surface	Barium (mg/kg)	6	6	100	168	222	192	184	208	168	222	192	184	208
surface	Barium (mg/l)	1	1	100	0.129	0.129	0.129	0.129	0.129	0.129	0.129	0.129	0.129	0.129
surface	Beryllium (mg/kg)	6	6	100	0.6	0.7	0.675	0.7	0.7	0.6	0.7	0.675	0.7	0.7
surface	Beryllium (mg/l)	1	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Calcium (mg/kg)	6	6	100	7410 J	8500 J	8010	8050 J	8390 J	7410 J	8500 J	8010	8050 J	8390 J
surface	Calcium (mg/l)	1	1	100	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6
surface	Cobalt (mg/kg)	6	6	100	17.8	20.1	18.7	18.2	19	17.8	20.1	18.7	18.2	19
surface	Cobalt (mg/l)	1	1	100	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
surface	Iron (mg/kg)	6	6	100	43100	44500	43800	43800	44400	43100	44500	43800	43800	44400
surface	Iron (mg/l)	1	1	100	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8
surface	Magnesium (mg/kg)	6	6	100	6350	7190	6770	6770	7100	6350	7190	6770	6770	7100
surface	Magnesium (mg/l)	1	1	100	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2
surface	Potassium (mg/kg)	6	6	100	1140	1360	1250	1240	1310	1140	1360	1250	1240	1310
surface	Potassium (mg/l)	1	1	100	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
surface	Sodium (mg/kg)	6	6	100	874	1100	1020	1000	1100	874	1100	1020	1000	1100
surface	Sodium (mg/l)	1	1	100	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1
surface	Vanadium (mg/kg)	6	6	100	104	122	112	110	115	104	122	112	110	115
surface	Vanadium (mg/l)	1	1	100	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
surface	2-Methylnaphthalene (ug/kg)	8	8	100	680	44000	12000	7600	18000	680	44000	12000	7600	18000
surface	Acenaphthene (ug/kg)	22	22	100	1100	1600000	161000	15000	180000 J	1100	1600000	161000	15000	180000 J
surface	Acenaphthylene (ug/kg)	22	21	95.5	220	285353	22300	1500	8800	220	285353	21300	1400	8800
surface	Anthracene (ug/kg)	22	22	100	1500	1100000	99100	13000	160000	1500	1100000	99100	13000	160000
surface	Fluorene (ug/kg)	22	22	100	450	800000	82000	10000	110000	450	800000	82000	10000	110000
surface	Naphthalene (ug/kg)	22	22	100	370	50622980	2560000	7940	180000	370	50622980	2560000	7940	180000
surface	Phenanthrene (ug/kg)	22	22	100	3500	5400000	461000	64000	280000	3500	5400000	461000	64000	280000
surface	Low Molecular Weight PAH (ug/kg)	22	22	100	8570 A	56500105 A	3380000	112400 A	771800 A	8570 A	56500105 A	3380000	112400 A	771800 A

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Dibenz(a,h)anthracene (ug/kg)	22	22	100	220 J	98000	9690	2200	9500 JT	220 J	98000	9690	2200	9500 JT
surface	Benz(a)anthracene (ug/kg)	22	22	100	2000 J	840000	81000	18000	100000	2000 J	840000	81000	18000	100000
surface	Benzo(a)pyrene (ug/kg)	22	22	100	3000 J	1000000	98700	23000	93000	3000 J	1000000	98700	23000	93000
surface	Benzo(b)fluoranthene (ug/kg)	22	22	100	1600 J	930000	73600	12000	59000	1600 J	930000	73600	12000	59000
surface	Benzo(g,h,i)perylene (ug/kg)	22	22	100	2500	820000	79000	13000 J	57000	2500	820000	79000	13000 J	57000
surface	Benzo(k)fluoranthene (ug/kg)	21	21	100	2100 J	350000	30200	12000	28000	2100 J	350000	30200	12000	28000
surface	Chrysene (ug/kg)	22	22	100	2900	1300000	112000	23000	140000	2900	1300000	112000	23000	140000
surface	Fluoranthene (ug/kg)	22	22	100	6500	3000000	271000	47000	320000	6500	3000000	271000	47000	320000
surface	Indeno(1,2,3-cd)pyrene (ug/kg)	22	22	100	1900	530000	57300	10000	46000	1900	530000	57300	10000	46000
surface	Pyrene (ug/kg)	22	22	100	8800	3400000	317000	80000	200000	8800	3400000	317000	80000	200000
surface	Benzo(b+k)fluoranthene (ug/kg)	20	20	100	3700 A	1280000 A	92800	22000 A	108000 A	3700 A	1280000 A	92800	22000 A	108000 A
surface	Benzo(j+k)fluoranthene (ug/kg)	1	1	100	374183	374183	374000	374183	374183	374183	374183	374000	374183	374183
surface	High Molecular Weight PAH (ug/kg)	22	22	100	31520 A	12268000 A	1140000	268800 A	1057400 A	31520 A	12268000 A	1140000	268800 A	1057400 A
surface	Polycyclic Aromatic Hydrocarbons (ug/kg)	22	22	100	60840 A	63355361 A	4530000	434400 A	1829200 A	60840 A	63355361 A	4530000	434400 A	1829200 A
surface	Benzo(e)pyrene (ug/kg)	1	1	100	362778	362778	363000	362778	362778	362778	362778	363000	362778	362778
surface	C1-Dibenzothiophene (ug/kg)	1	1	100	101060	101060	101000	101060	101060	101060	101060	101000	101060	101060
surface	C1-Chrysene (ug/kg)	1	1	100	147659	147659	148000	147659	147659	147659	147659	148000	147659	147659
surface	C1-Fluorene (ug/kg)	1	1	100	148290	148290	148000	148290	148290	148290	148290	148000	148290	148290
surface	C1-Naphthalene (ug/kg)	1	1	100	1819519	1819519	1820000	1819519	1819519	1819519	1819519	1820000	1819519	1819519
surface	C1-Fluoranthene/pyrene (ug/kg)	1	1	100	483445	483445	483000	483445	483445	483445	483445	483000	483445	483445
surface	C1-Phenanthrene/anthracene (ug/kg)	1	1	100	571373	571373	571000	571373	571373	571373	571373	571000	571373	571373
surface	C2-Dibenzothiophene (ug/kg)	1	1	100	62583	62583	62600	62583	62583	62583	62583	62600	62583	62583
surface	C2-Chrysene (ug/kg)	1	1	100	42490	42490	42500	42490	42490	42490	42490	42500	42490	42490
surface	C2-Fluorene (ug/kg)	1	1	100	74879	74879	74900	74879	74879	74879	74879	74900	74879	74879
surface	C2-Naphthalene (ug/kg)	1	1	100	789661	789661	790000	789661	789661	789661	789661	790000	789661	789661
surface	C2-Fluoranthene/pyrene (ug/kg)	1	1	100	105280	105280	105000	105280	105280	105280	105280	105000	105280	105280
surface	C2-Phenanthrene/anthracene (ug/kg)	1	1	100	216546	216546	217000	216546	216546	216546	216546	217000	216546	216546
surface	C3-Dibenzothiophene (ug/kg)	1	1	100	33235	33235	33200	33235	33235	33235	33235	33200	33235	33235
surface	C3-Chrysene (ug/kg)	1	1	100	17094	17094	17100	17094	17094	17094	17094	17100	17094	17094
surface	C3-Fluorene (ug/kg)	1	1	100	38414	38414	38400	38414	38414	38414	38414	38400	38414	38414
surface	C3-Naphthalene (ug/kg)	1	1	100	283227	283227	283000	283227	283227	283227	283227	283000	283227	283227
surface	C3-Fluoranthene/pyrene (ug/kg)	1	1	100	35546	35546	35500	35546	35546	35546	35546	35500	35546	35546
surface	C3-Phenanthrene/anthracene (ug/kg)	1	1	100	74962	74962	75000	74962	74962	74962	74962	75000	74962	74962
surface	C4-Dibenzothiophene (ug/kg)	1	1	100	11744	11744	11700	11744	11744	11744	11744	11700	11744	11744
surface	C4-Chrysene (ug/kg)	1	1	100	4066	4066	4070	4066	4066	4066	4066	4070	4066	4066
surface	C4-Naphthalene (ug/kg)	1	1	100	91693	91693	91700	91693	91693	91693	91693	91700	91693	91693
surface	C4-Phenanthrene/anthracene (ug/kg)	1	1	100	21991	21991	22000	21991	21991	21991	21991	22000	21991	21991
surface	Total benzofluoranthenes (b+k (+j)) (ug/kg)	1	1	100	717060	717060	717000	717060	717060	717060	717060	717000	717060	717060
surface	2,4'-DDD (ug/kg)	1	0	0						7.7 U	7.7 U	7.7	7.7 U	7.7 U
surface	4,4'-DDD (ug/kg)	4	2	50	1200	1200	1200	1200	1200	9 U	1200	605	9 U	1200
surface	2,4'-DDE (ug/kg)	1	0	0						200 U	200 U	200	200 U	200 U
surface	2,4'-DDT (ug/kg)	1	0	0						7.7 U	7.7 U	7.7	7.7 U	7.7 U
surface	4,4'-DDT (ug/kg)	4	2	50	2500	2500	2500	2500	2500	12 U	2500	1260	12 U	2500
surface	4,4'-DDE (ug/kg)	4	2	50	100	100	100	100	100	7.7 U	100	53.9	7.7 U	100
surface	Total of 3 isomers: pp-DDT,-DDD,-DDE (ug/kg)	2	1	50	3800 A	3800 A	3800	3800 A	3800 A	12 U	3800 A	1910	12 U	12 U
surface	Aldrin (ug/kg)	2	1	50	60	60	60	60	60	3.9 U	60	32	3.9 U	3.9 U
surface	alpha-Hexachlorocyclohexane (ug/kg)	2	0	0						3.9 U	60 U	32	3.9 U	3.9 U
surface	beta-Hexachlorocyclohexane (ug/kg)	2	0	0						42 U	60 U	51	42 U	42 U
surface	delta-Hexachlorocyclohexane (ug/kg)	2	0	0						3.9 U	60 U	32	3.9 U	3.9 U

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Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	gamma-Hexachlorocyclohexane (ug/kg)	2	1	50	540	540	540	540	540	3.9 U	540	272	3.9 U	3.9 U
surface	cis-Chlordane (ug/kg)	1	0	0						3.9 U	3.9 U	3.9	3.9 U	3.9 U
surface	trans-Chlordane (ug/kg)	1	0	0						3.9 U	3.9 U	3.9	3.9 U	3.9 U
surface	Oxychlordane (ug/kg)	1	0	0						7.7 U	7.7 U	7.7	7.7 U	7.7 U
surface	cis-Nonachlor (ug/kg)	1	0	0						7.7 U	7.7 U	7.7	7.7 U	7.7 U
surface	trans-Nonachlor (ug/kg)	1	0	0						7.7 U	7.7 U	7.7	7.7 U	7.7 U
surface	Dieldrin (ug/kg)	2	0	0						7.7 U	60 U	33.9	7.7 U	7.7 U
surface	alpha-Endosulfan (ug/kg)	2	0	0						3.9 U	60 U	32	3.9 U	3.9 U
surface	beta-Endosulfan (ug/kg)	2	0	0						7.7 U	60 U	33.9	7.7 U	7.7 U
surface	Endosulfan sulfate (ug/kg)	2	0	0						7.7 U	60 U	33.9	7.7 U	7.7 U
surface	Endrin (ug/kg)	2	0	0						13 U	60 U	36.5	13 U	13 U
surface	Endrin aldehyde (ug/kg)	2	0	0						11 U	60 U	35.5	11 U	11 U
surface	Endrin ketone (ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
surface	Heptachlor (ug/kg)	2	0	0						3.9 U	60 U	32	3.9 U	3.9 U
surface	Heptachlor epoxide (ug/kg)	2	0	0						3.9 U	60 U	32	3.9 U	3.9 U
surface	Methoxychlor (ug/kg)	2	0	0						39 U	300 U	170	39 U	39 U
surface	Mirex (ug/kg)	1	0	0						55 U	55 U	55	55 U	55 U
surface	Toxaphene (ug/kg)	2	0	0						680 U	12000 U	6340	680 U	680 U
surface	Chlordane (cis & trans) (ug/kg)	1	0	0						1000 U	1000 U	1000	1000 U	1000 U
surface	Diphenyl (ug/kg)	1	1	100	512492	512492	512000	512492	512492	512492	512492	512000	512492	512492
surface	Diesel fuels (mg/kg)	5	3	60	50 G	50 G	50	50 G	50 G	50 G	50 U	50	50 G	50 U
surface	Heavy oil (mg/kg)	3	3	100	91	5100	1810	240	240	91	5100	1810	240	240
surface	Lube Oil (mg/kg)	5	3	60	100 G	100 G	100	100 G	100 G	100 G	100 U	100	100 G	100 U
surface	Natural gasoline (mg/kg)	6	2	33.3	20 G	300	160	20 G	20 G	20 U	300	66.7	20 G	20 U
surface	2,3,4,6-Tetrachlorophenol (ug/kg)	1	0	0						490 U	490 U	490	490 U	490 U
surface	2,4,5-Trichlorophenol (ug/kg)	7	0	0						97 U	1000 U	588	490 U	980 U
surface	2,4,6-Trichlorophenol (ug/kg)	7	0	0						97 U	1000 U	588	490 U	980 U
surface	2,4-Dichlorophenol (ug/kg)	7	0	0						58 U	600 U	352	290 U	590 U
surface	2,4-Dimethylphenol (ug/kg)	7	0	0						19 U	290 U	145	190 U	200 U
surface	2,4-Dinitrophenol (ug/kg)	7	0	0						190 UJ	2000 UJ	1180	980 UJ	2000 UJ
surface	2-Chlorophenol (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	2-Methylphenol (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	2-Nitrophenol (ug/kg)	7	0	0						97 U	1000 U	588	490 U	980 U
surface	4,6-Dinitro-2-methylphenol (ug/kg)	7	0	0						190 U	2000 U	1180	980 UJ	2000 U
surface	4-Chloro-3-methylphenol (ug/kg)	7	0	0						39 U	400 U	235	200 U	390 U
surface	4-Methylphenol (ug/kg)	7	4	57.1	160	300	228	200	250	98 U	300	200	200 U	250
surface	4-Nitrophenol (ug/kg)	7	0	0						97 U	1000 U	588	490 U	980 U
surface	Pentachlorophenol (ug/kg)	7	0	0						97 UJ	1000 U	588	490 UT	980 UJ
surface	Phenol (ug/kg)	7	0	0						19 U	200 U	132	190 U	200 U
surface	2,3,4,5-Tetrachlorophenol (ug/kg)	1	0	0						490 U	490 U	490	490 U	490 U
surface	2,3,5,6-Tetrachlorophenol (ug/kg)	1	0	0						490 U	490 U	490	490 U	490 U
surface	Dimethyl phthalate (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	Diethyl phthalate (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	Dibutyl phthalate (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	Butylbenzyl phthalate (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	Di-n-octyl phthalate (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	Bis(2-ethylhexyl) phthalate (ug/kg)	7	2	28.6	150	340	245	150	150	98 U	340	190	200 U	210 U
surface	1,2,4-Trichlorobenzene (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	1,2-Dichlorobenzene (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	1,3-Dichlorobenzene (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	1,4-Dichlorobenzene (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	Azobenzene (ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
surface	Bis(2-chloro-1-methylethyl) ether (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	2,4-Dinitrotoluene (ug/kg)	7	0	0						97 U	1000 U	588	490 U	980 U
surface	2,6-Dinitrotoluene (ug/kg)	7	0	0						97 U	1000 U	588	490 U	980 U
surface	2-Chloronaphthalene (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	2-Nitroaniline (ug/kg)	7	0	0						97 U	1000 U	588	490 U	980 U
surface	3,3'-Dichlorobenzidine (ug/kg)	7	0	0						97 U	1000 U	588	490 U	980 U
surface	3-Nitroaniline (ug/kg)	7	0	0						120 U	1200 U	714	590 U	1200 U
surface	4-Bromophenyl phenyl ether (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	4-Chloroaniline (ug/kg)	7	0	0						58 U	600 U	352	290 U	590 U
surface	4-Chlorophenyl phenyl ether (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	4-Nitroaniline (ug/kg)	7	0	0						97 U	1000 U	588	490 U	980 U
surface	Aniline (ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
surface	Benzoic acid (ug/kg)	7	0	0						190 U	2000 U	1180	980 UJ	2000 U
surface	Benzyl alcohol (ug/kg)	7	0	0						19 UJ	490 U	174	190 U	200 U
surface	Bis(2-chloroethoxy) methane (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	Bis(2-chloroethyl) ether (ug/kg)	7	0	0						39 U	400 U	235	200 U	390 U
surface	Carbazole (ug/kg)	7	7	100	260 J	8400 J	3440	2800 T	5500	260 J	8400 J	3440	2800 T	5500
surface	Dibenzofuran (ug/kg)	9	9	100	530	99303	13800	1600	13900	530	99303	13800	1600	13900
surface	Hexachlorobenzene (ug/kg)	7	0	0						3.9 UT	200 U	104	96 U	200 U
surface	Hexachlorobutadiene (ug/kg)	7	0	0						3.9 UT	200 U	104	96 U	200 U
surface	Hexachlorocyclopentadiene (ug/kg)	7	0	0						97 UJ	1000 U	588	490 U	980 UJ
surface	Hexachloroethane (ug/kg)	7	0	0						19 U	200 U	118	98 UT	200 U
surface	Isophorone (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	Nitrobenzene (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	N-Nitrosodimethylamine (ug/kg)	1	0	0						490 U	490 U	490	490 U	490 U
surface	N-Nitrosodipropylamine (ug/kg)	7	0	0						39 U	400 U	235	200 U	390 U
surface	N-Nitrosodiphenylamine (ug/kg)	7	0	0						19 U	200 U	118	98 U	200 U
surface	Dibenzothiophene (ug/kg)	1	1	100	391684	391684	392000	391684	391684	391684	391684	392000	391684	391684
surface	Perylene (ug/kg)	1	1	100	160789	160789	161000	160789	160789	160789	160789	161000	160789	160789
surface	Benzene (ug/kg)	12	3	25	0.05 J	22000	7330	0.36	0.36	0.01 U	22000	1930	0.05 J	300 U
surface	Ethylbenzene (ug/kg)	12	7	58.3	0.06 J	10000	1430	0.2 J	2	0.009 U	10000	934	0.22	300 U
surface	m,p-Xylene (ug/kg)	7	6	85.7	0.05 J	0.64	0.167	0.08 J	0.1 J	0.02 U	0.64	0.146	0.08 J	0.1 J
surface	o-Xylene (ug/kg)	7	6	85.7	0.03 J	0.87	0.22	0.07 J	0.21	0.008 U	0.87	0.19	0.07 J	0.21
surface	Toluene (ug/kg)	12	2	16.7	0.08 J	4200	2100	0.08 J	0.08 J	0.02 U	4200	450	0.02 U	300 U
surface	Xylene (ug/kg)	5	1	20	18000	18000	18000	18000	18000	300 U	18000	3840	300 U	300 U
subsurface	Aroclor 1242 (ug/kg)	1	0	0						60 U	60 U	60	60 U	60 U
subsurface	Aroclor 1248 (ug/kg)	1	0	0						60 U	60 U	60	60 U	60 U
subsurface	Aroclor 1254 (ug/kg)	1	0	0						60 U	60 U	60	60 U	60 U
subsurface	Aroclor 1260 (ug/kg)	1	0	0						60 U	60 U	60	60 U	60 U
subsurface	Polychlorinated biphenyls (ug/kg)	1	0	0						60 UA	60 UA	60	60 UA	60 UA
subsurface	Total solids (percent)	17	17	100	40.3	67.6	56	56.7	66.1	40.3	67.6	56	56.7	66.1
subsurface	Total organic carbon (percent)	15	15	100	1.57	8.76	3.56	3.15	5.15	1.57	8.76	3.56	3.15	5.15
subsurface	Total sulfides (mg/kg)	1	1	100	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9
subsurface	Total volatile solids (percent)	1	1	100	11	11	11	11	11	11	11	11	11	11
subsurface	Cyanide (mg/kg)	14	14	100	0.2 J	5.4	1.68	1	3.7	0.2 J	5.4	1.68	1	3.7
subsurface	Gravel (percent)	1	1	100	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Table 2. Queried Sediment Chemistry Data

Surface or		Number	Number	%	Detected Concentrations					Detected and Nondetected Concentrations				
Subsurface	Analyte	of Samples	Detected	Detected	Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
subsurface	Sand (percent)	1	1	100	37	37	37	37	37	37	37	37	37	37
subsurface	Fines (percent)	1	1	100	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9
subsurface	Silt (percent)	1	1	100	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6
subsurface	Clay (percent)	1	1	100	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
subsurface	Mean grain size (mm)	1	1	100	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684
subsurface	Median grain size (mm)	1	1	100	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
subsurface	Arsenic (mg/kg)	15	15	100	3.1	5.1	3.9	3.9	5	3.1	5.1	3.9	3.9	5
subsurface	Cadmium (mg/kg)	1	1	100	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
subsurface	Chromium (mg/kg)	15	15	100	22.9	39	30.6	31.6	36.4	22.9	39	30.6	31.6	36.4
subsurface	Copper (mg/kg)	15	15	100	31.9	57.6	43.6	44.4	56.5	31.9	57.6	43.6	44.4	56.5
subsurface	Lead (mg/kg)	23	23	100	2.3	335	40.5	25.7	58.4	2.3	335	40.5	25.7	58.4
subsurface	Mercury (mg/kg)	1	1	100	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148
subsurface	Nickel (mg/kg)	15	15	100	20.4	33	27.4	28	31.3	20.4	33	27.4	28	31.3
subsurface	Silver (mg/kg)	1	0	0						0.01 U	0.01 U	0.01	0.01 U	0.01 U
subsurface	Zinc (mg/kg)	15	15	100	91 J	313 J	151	132 J	222 J	91 J	313 J	151	132 J	222 J
subsurface	2-Methylnaphthalene (ug/kg)	4	4	100	2090	19600	10200	3700	15400	2090	19600	10200	3700	15400
subsurface	Acenaphthene (ug/kg)	23	22	95.7	54	580000 J	86700	30000 J	170000 J	50 U	580000 J	82900	30000 J	170000 J
subsurface	Acenaphthylene (ug/kg)	23	18	78.3	240	28000	4340	1600	13000	50 U	28000	3450	900	9000 J
subsurface	Anthracene (ug/kg)	23	22	95.7	72	250000	51000	21000	190000	50 U	250000	48800	21000	190000
subsurface	Fluorene (ug/kg)	23	21	91.3	240	260000	46000	21000	120000	50 U	260000	42000	17000	120000
subsurface	Naphthalene (ug/kg)	23	22	95.7	60	1900000 J	203000	17000	580000	50 U	1900000 J	194000	17000	580000
subsurface	Phenanthrene (ug/kg)	23	22	95.7	260	1300000	249000	100000	770000	50 U	1300000	238000	100000	770000
subsurface	Low Molecular Weight PAH (ug/kg)	23	22	95.7	446 A	4299000 A	637000	208900 A	1843000 A	50 UA	4299000 A	610000	208900 A	1843000 A
subsurface	Dibenz(a,h)anthracene (ug/kg)	23	19	82.6	730	16000	3540	1600	10000 J	50 U	75000 U	6200	1530	10000 J
subsurface	Benz(a)anthracene (ug/kg)	23	22	95.7	96	150000	33000	15000	120000	50 U	150000	31600	15000	120000
subsurface	Benzo(a)pyrene (ug/kg)	23	22	95.7	170	180000	36400	17300	110000	50 U	180000	34800	17300	110000
subsurface	Benzo(b)fluoranthene (ug/kg)	22	21	95.5	140	160000	25100	9300	65000	50 U	160000	24000	8800	65000
subsurface	Benzo(g,h,i)perylene (ug/kg)	23	22	95.7	210	140000	26900	15000	75000	50 U	140000	25700	15000	75000
subsurface	Benzo(k)fluoranthene (ug/kg)	22	21	95.5	56	92000	20600	13000	42000	50 U	92000	19700	12000	42000
subsurface	Chrysene (ug/kg)	23	22	95.7	150	180000	42100	21000	140000	50 U	180000	40300	21000	140000
subsurface	Fluoranthene (ug/kg)	23	22	95.7	340	540000	117000	61000	340000	50 U	540000	112000	61000	340000
subsurface	Indeno(1,2,3-cd)pyrene (ug/kg)	23	22	95.7	120	90000	20400	11000	48000	50 U	90000	19500	11000	48000
subsurface	Pyrene (ug/kg)	23	22	95.7	470	670000	150000	77000	440000	50 U	670000	143000	77000	440000
subsurface	Benzo(b+k)fluoranthene (ug/kg)	23	22	95.7	196 A	217000 A	44000	20300 A	136000 A	50 UA	217000 A	42100	20300 A	136000 A
subsurface	High Molecular Weight PAH (ug/kg)	23	22	95.7	1752 A	2063000 A	472000	247400 A	1419000 A	50 UA	2063000 A	452000	247400 A	1419000 A
subsurface	Polycyclic Aromatic Hydrocarbons (ug/kg)	23	22	95.7	2198 A	6192000 A	1110000	445000 A	3262000 A	50 UA	6192000 A	1060000	445000 A	3262000 A
subsurface	4,4'-DDD (ug/kg)	8	8	100	120	760	370	130	760	120	760	370	130	760
subsurface	4,4'-DDT (ug/kg)	8	4	50	40	80	60	40	80	1 U	170 U	72.8	40	170 U
subsurface	4,4'-DDE (ug/kg)	8	2	25	3 J	3 J	3	3 J	3 J	3 J	60 U	32.3	6 U	60 U
subsurface	Total of 3 isomers: pp-DDT,-DDD,-DDE (ug/kg)	4	4	100	170 A	760 A	401	203 A	470 A	170 A	760 A	401	203 A	470 A
subsurface	Aldrin (ug/kg)	4	1	25	9 J	9 J	9	9 J	9 J	1 U	90 U	25.8	3 U	9 J
subsurface	alpha-Hexachlorocyclohexane (ug/kg)	4	3	75	3 J	7 J	5.33	6 J	6 J	3 J	7 J	4.75	3 U	6 J
subsurface	beta-Hexachlorocyclohexane (ug/kg)	4	0	0						2 U	3 U	2.25	2 U	2 U
subsurface	delta-Hexachlorocyclohexane (ug/kg)	4	0	0						2 U	5 U	2.75	2 U	2 U
subsurface	gamma-Hexachlorocyclohexane (ug/kg)	4	3	75	50	360	237	300	300	3 U	360	178	50	300
subsurface	cis-Chlordane (ug/kg)	1	0	0						5 U	5 U	5	5 U	5 U
subsurface	Dieldrin (ug/kg)	4	1	25	11	11	11	11	11	2 U	60 U	33.3	11	60 U
subsurface	alpha-Endosulfan (ug/kg)	4	0	0						1 U	60 U	31	3 U	60 U
subsurface	beta-Endosulfan (ug/kg)	4	0	0						6 U	60 U	44	50 U	60 U

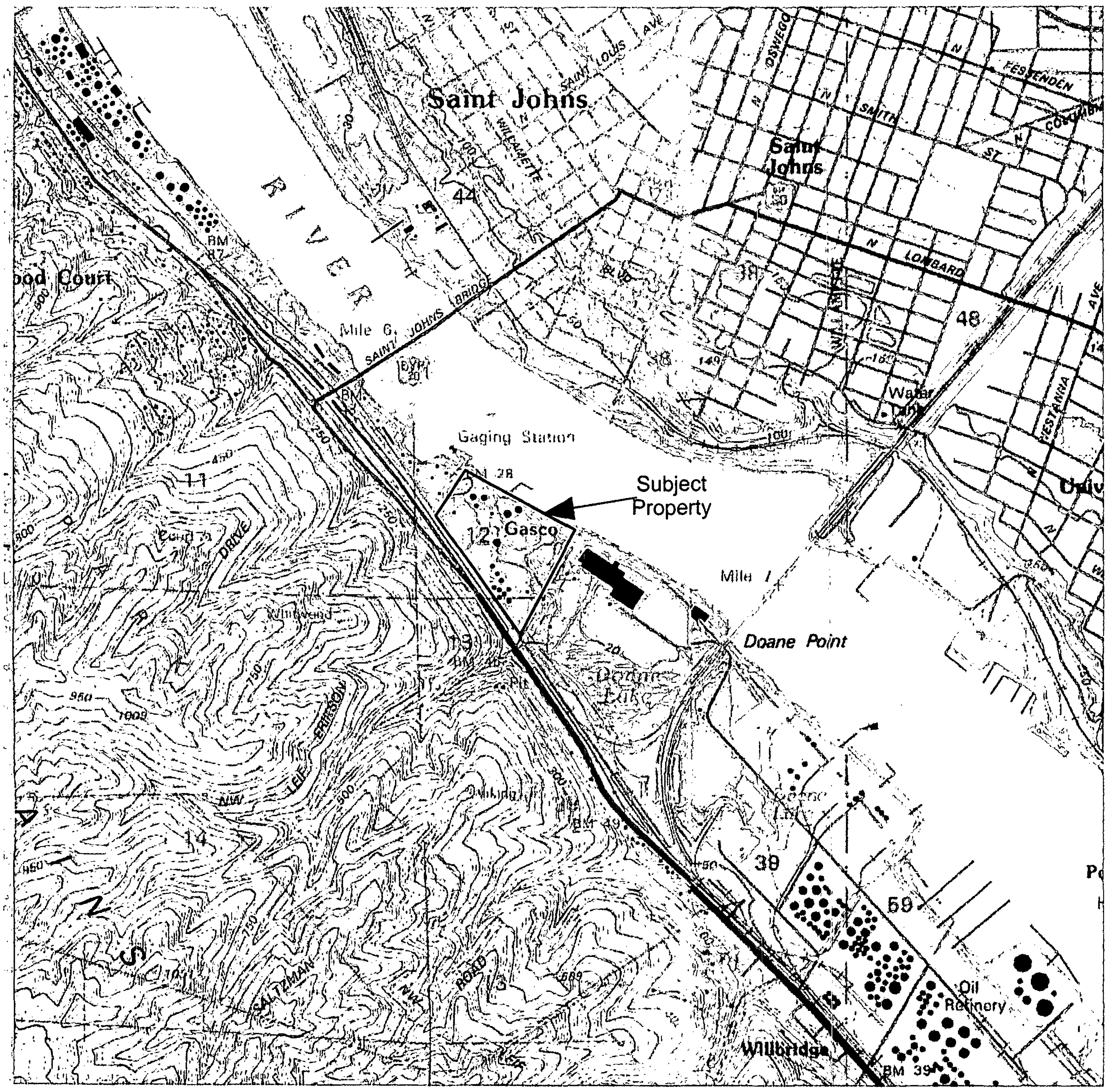
Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
subsurface	Endosulfan sulfate (ug/kg)	4	0	0						12 U	60 U	45.5	50 U	60 U
subsurface	Endrin (ug/kg)	4	0	0						6 U	60 U	44	50 U	60 U
subsurface	Endrin aldehyde (ug/kg)	3	0	0						50 U	60 U	56.7	60 U	60 U
subsurface	Endrin ketone (ug/kg)	1	0	0						9 U	9 U	9	9 U	9 U
subsurface	Heptachlor (ug/kg)	4	0	0						1 U	3 U	1.5	1 U	1 U
subsurface	Heptachlor epoxide (ug/kg)	4	1	25	5 J	5 J	5	5 J	5 J	3 U	60 U	32	5 J	60 U
subsurface	Methoxychlor (ug/kg)	4	0	0						12 U	300 U	203	200 U	300 U
subsurface	Toxaphene (ug/kg)	4	0	0						450 U	4000 U	2610	3000 U	3000 U
subsurface	gamma-Chlordane (ug/kg)	1	0	0						5 U	5 U	5	5 U	5 U
subsurface	Chlordane (cis & trans) (ug/kg)	3	0	0						21 U	900 U	440	400 U	400 U
subsurface	Diesel fuels (mg/kg)	3	0	0						50 U	50 U	50	50 U	50 U
subsurface	Heavy oil (mg/kg)	2	2	100	380	910	645	380	380	380	910	645	380	380
subsurface	Lube Oil (mg/kg)	3	0	0						100 U	100 U	100	100 U	100 U
subsurface	Natural gasoline (mg/kg)	5	2	40	44	110	77	44	44	20 U	110	42.8	20 U	44
subsurface	2,4,5-Trichlorophenol (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	2,4,6-Trichlorophenol (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	2,4-Dichlorophenol (ug/kg)	1	0	0						1600 U	1600 U	1600	1600 U	1600 U
subsurface	2,4-Dimethylphenol (ug/kg)	1	0	0						1000 U	1000 U	1000	1000 U	1000 U
subsurface	2,4-Dinitrophenol (ug/kg)	1	0	0						5200 U	5200 U	5200	5200 U	5200 U
subsurface	2-Chlorophenol (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	2-Methylphenol (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	2-Nitrophenol (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	4,6-Dinitro-2-methylphenol (ug/kg)	1	0	0						5200 U	5200 U	5200	5200 U	5200 U
subsurface	4-Chloro-3-methylphenol (ug/kg)	1	0	0						1000 U	1000 U	1000	1000 U	1000 U
subsurface	4-Methylphenol (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	4-Nitrophenol (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	Pentachlorophenol (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	Phenol (ug/kg)	1	0	0						1000 U	1000 U	1000	1000 U	1000 U
subsurface	Dimethyl phthalate (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	Diethyl phthalate (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	Dibutyl phthalate (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	Butylbenzyl phthalate (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	Di-n-octyl phthalate (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	Bis(2-ethylhexyl) phthalate (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	1,2,4-Trichlorobenzene (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	1,2-Dichlorobenzene (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	1,3-Dichlorobenzene (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	1,4-Dichlorobenzene (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	Bis(2-chloro-1-methylethyl) ether (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	2,4-Dinitrotoluene (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	2,6-Dinitrotoluene (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	2-Chloronaphthalene (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	2-Nitroaniline (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	3,3'-Dichlorobenzidine (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	3-Nitroaniline (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	4-Bromophenyl phenyl ether (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	4-Chloroaniline (ug/kg)	1	0	0						1600 U	1600 U	1600	1600 U	1600 U
subsurface	4-Chlorophenyl phenyl ether (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	4-Nitroaniline (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
subsurface	Benzoic acid (ug/kg)	1	0	0						5200 U	5200 U	5200	5200 U	5200 U
subsurface	Benzyl alcohol (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	Bis(2-chloroethoxy) methane (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	Bis(2-chloroethyl) ether (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	Dibenzofuran (ug/kg)	4	3	75	770	2290	1450	1290	1290	300 U	2290	1160	770	1290
subsurface	Hexachlorobenzene (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	Hexachlorobutadiene (ug/kg)	1	0	0						1000 U	1000 U	1000	1000 U	1000 U
subsurface	Hexachlorocyclopentadiene (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	Hexachloroethane (ug/kg)	1	0	0						1000 U	1000 U	1000	1000 U	1000 U
subsurface	Isophorone (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	Nitrobenzene (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	N-Nitrosodipropylamine (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	N-Nitrosodiphenylamine (ug/kg)	1	0	0						520 U	520 U	520	520 U	520 U
subsurface	3,4,5-Trichloroguaiacol (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	4,5,6-Trichloroguaiacol (ug/kg)	1	0	0						2600 U	2600 U	2600	2600 U	2600 U
subsurface	Guaiacol (ug/kg)	1	0	0						1000 U	1000 U	1000	1000 U	1000 U
subsurface	Tetrachloroguaiacol (ug/kg)	1	0	0						1600 U	1600 U	1600	1600 U	1600 U
subsurface	Benzene (ug/kg)	19	8	42.1	0.03 J	1800	226	0.04 J	6.4	0.02 U	1800	158	0.04 J	300 U
subsurface	Ethylbenzene (ug/kg)	19	13	68.4	0.05 J	6200	579	0.36	1300	0.02 U	6200	443	0.36	1300
subsurface	m,p-Xylene (ug/kg)	14	10	71.4	0.03 J	5.1	0.719	0.1 J	1.2	0.03 U	5.1	0.523	0.06 J	1.2
subsurface	o-Xylene (ug/kg)	14	14	100	0.02 J	4	0.446	0.09 J	0.84	0.02 J	4	0.446	0.09 J	0.84
subsurface	Toluene (ug/kg)	19	4	21.1	0.03 J	0.3 J	0.108	0.03 J	0.07 J	0.02 U	300 U	79	0.02 U	300 U
subsurface	Xylene (ug/kg)	5	2	40	1300	6000	3650	1300	1300	300 U	6000	1640	300 U	1300

SUPPLEMENTAL FIGURES



Note: Base Map from Linnton (1990) and Portland (1990), Oregon, USGS 7.5-Minute Quadrangles

N

0 2,000 4,000

Approximate Scale in Feet
Contour Interval = 10 feet

FIGURE 1

Location Map

NW Natural Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
Project No. 2708 March 2004

File: 2708-01 Location Map

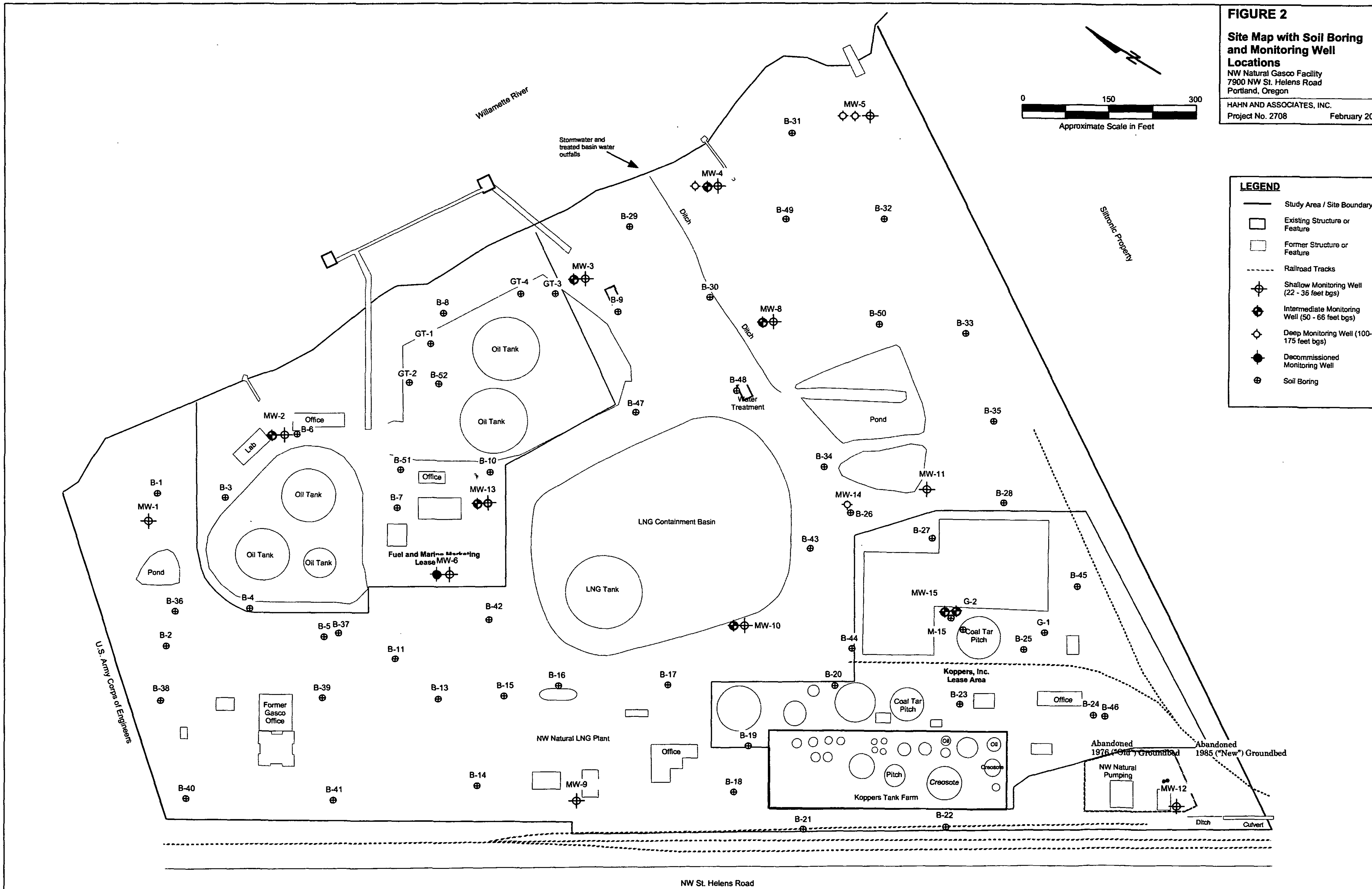


FIGURE 2

Site Map with Soil Boring and Monitoring Well Locations

NW Natural Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
Project No. 2708 February 2004

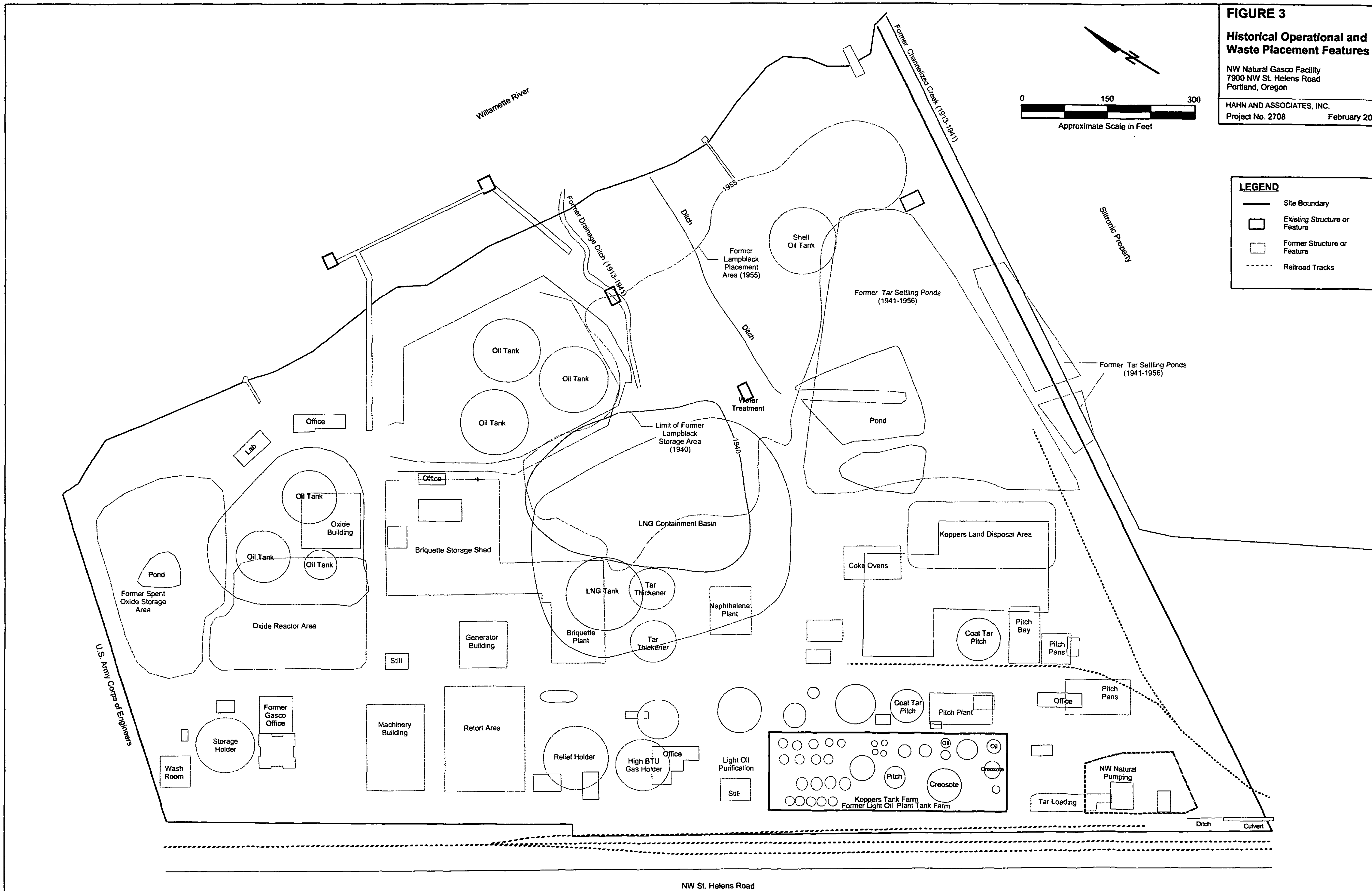


FIGURE 3

Historical Operational and Waste Placement Features

NW Natural Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
Project No. 2708 February 2004

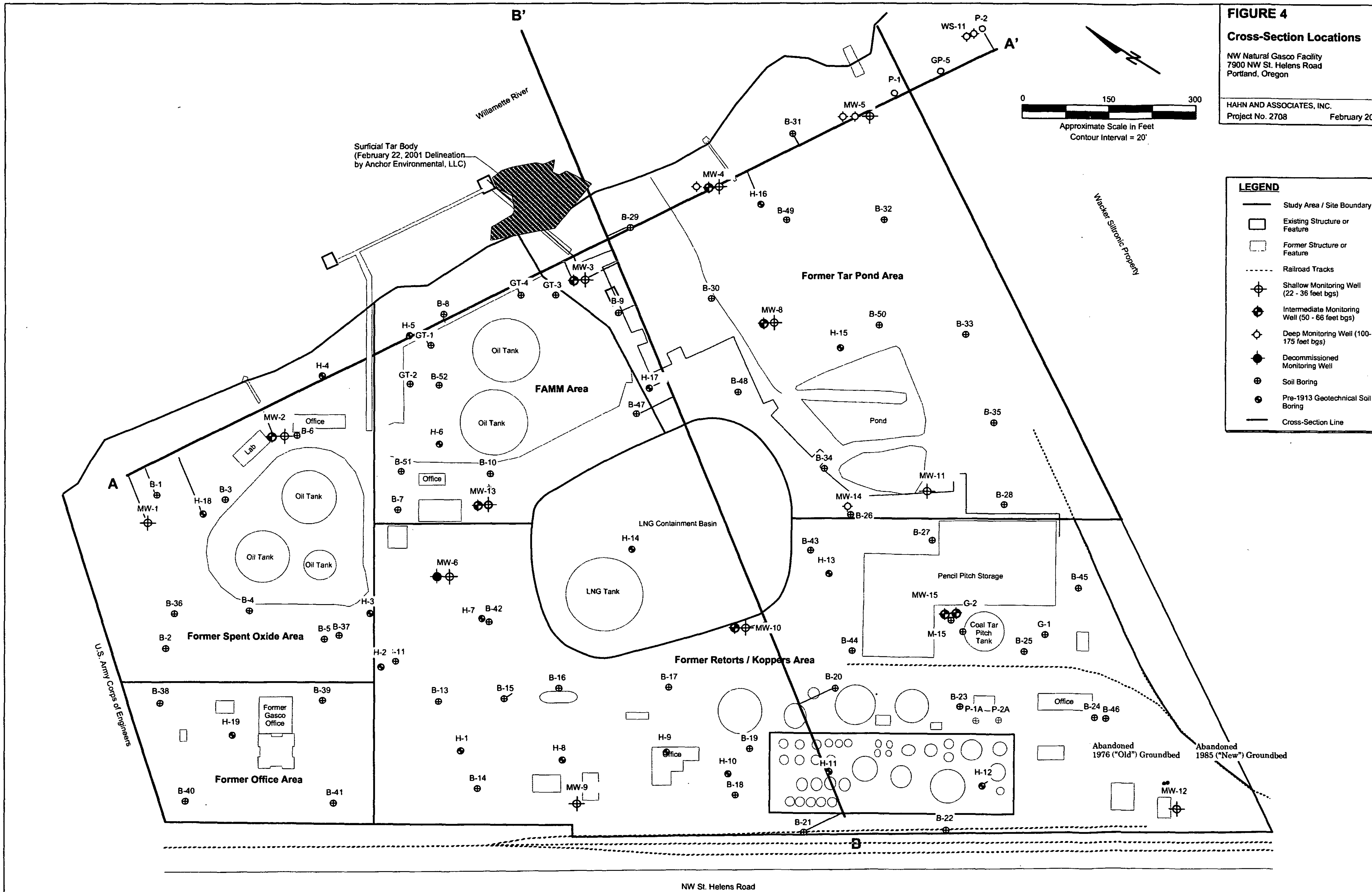


FIGURE 4
Cross-Section Locations

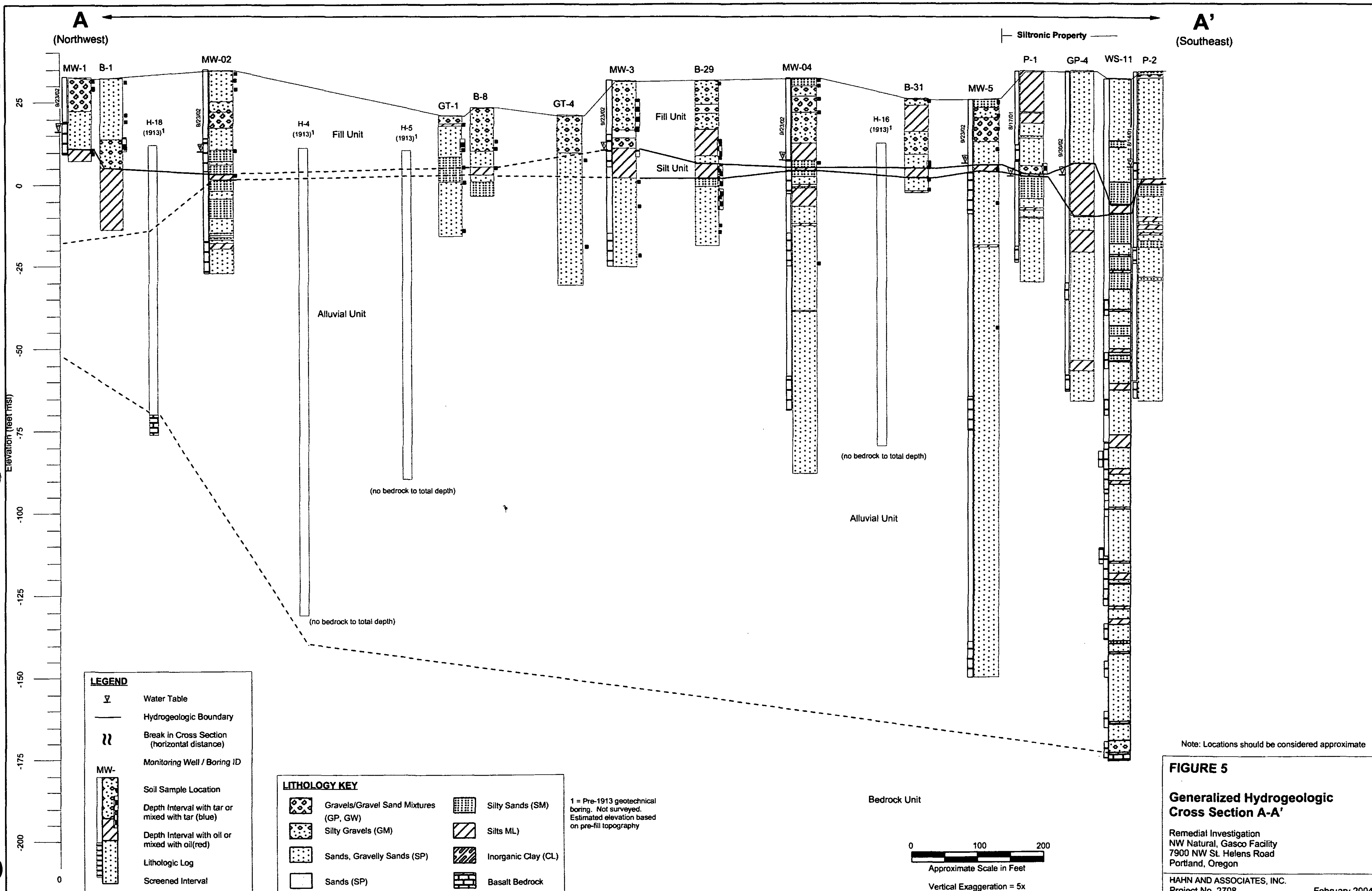


FIGURE 5
Generalized Hydrogeologic Cross Section A-A'

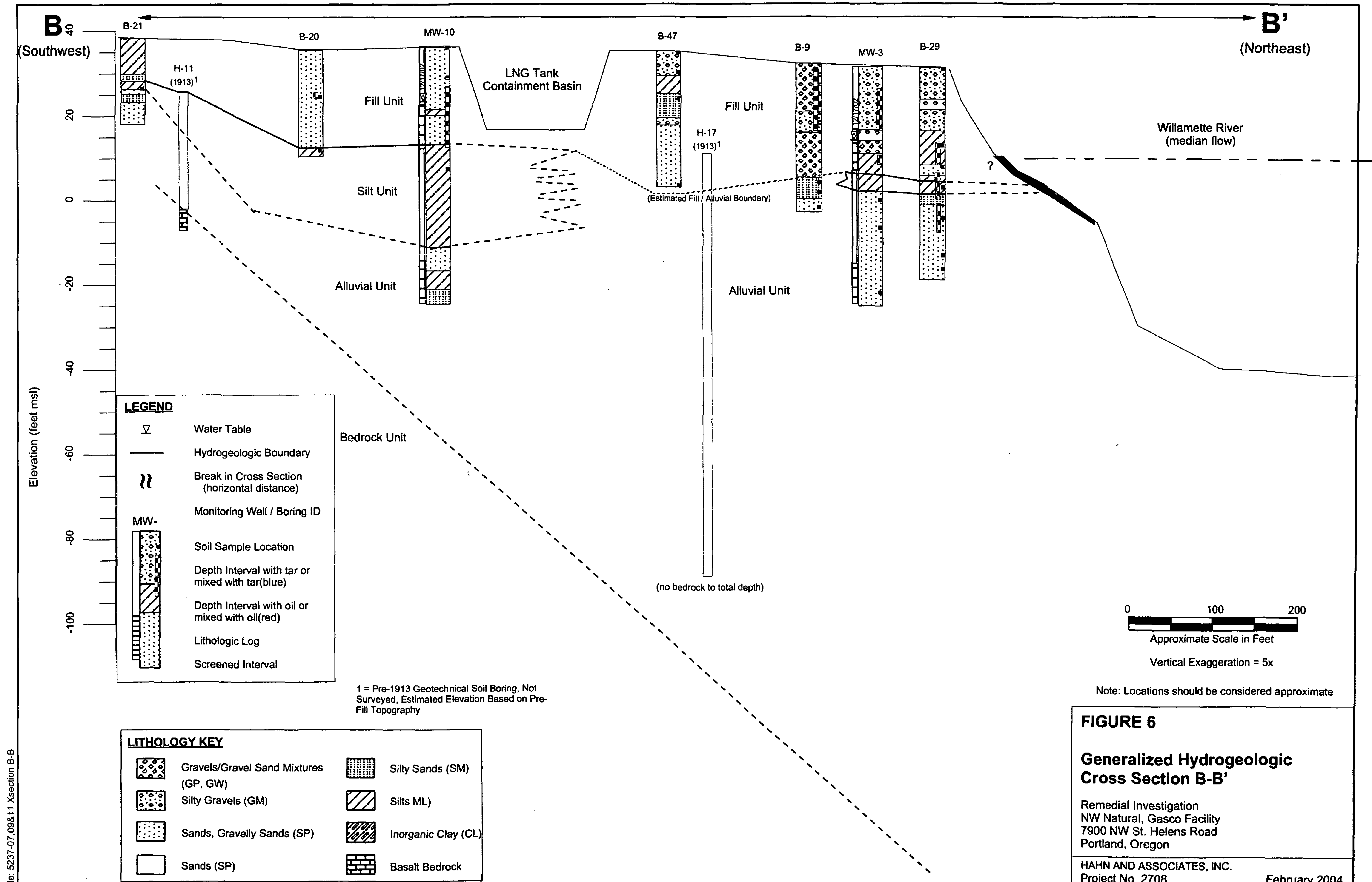


FIGURE 6

Generalized Hydrogeologic Cross Section B-B'

Remedial Investigation
NW Natural, Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
Project No. 2708 February 2004

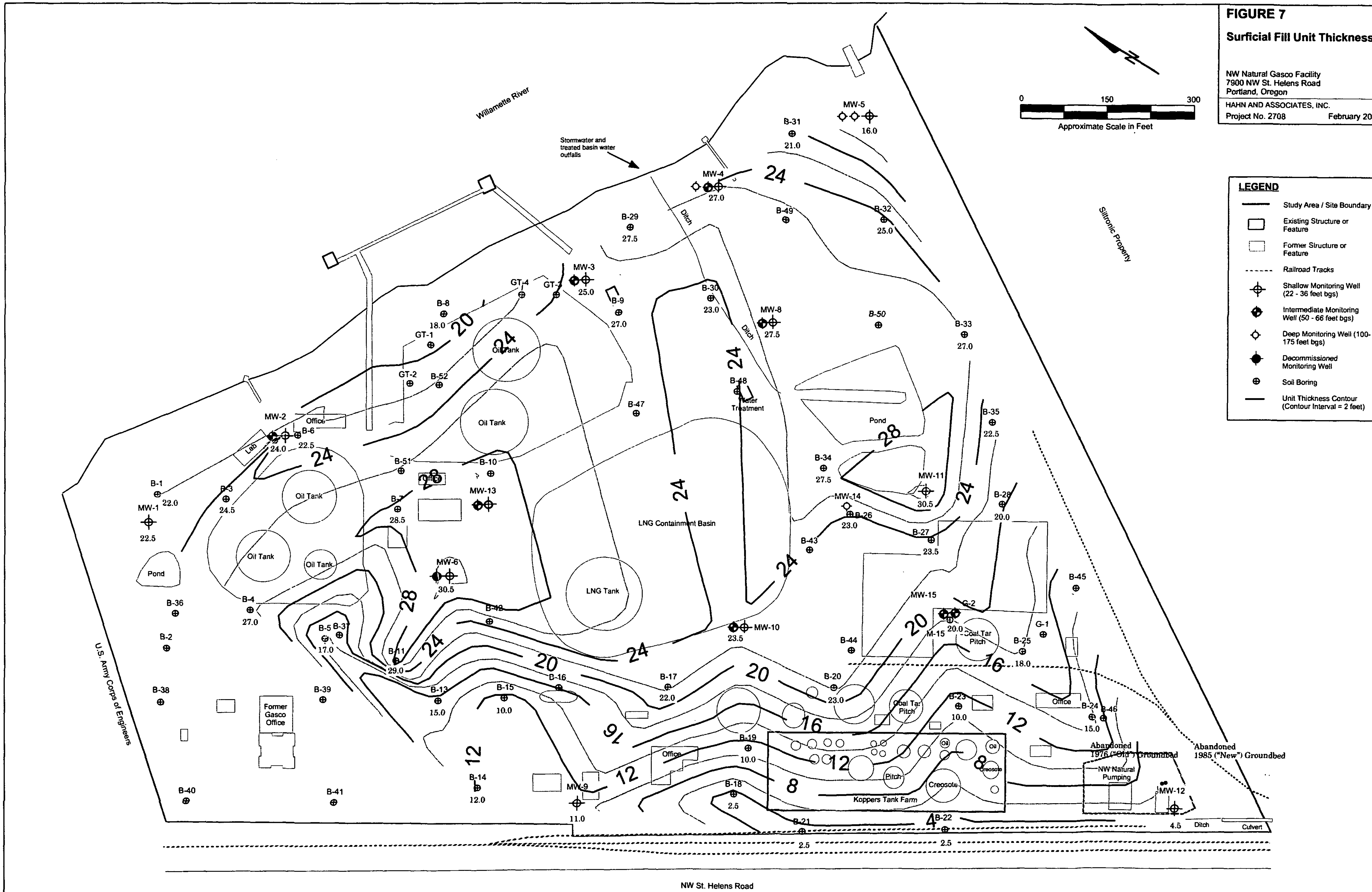


FIGURE 7

Surficial Fill Unit Thickness

NW Natural Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.

Project No. 2708 February 2004

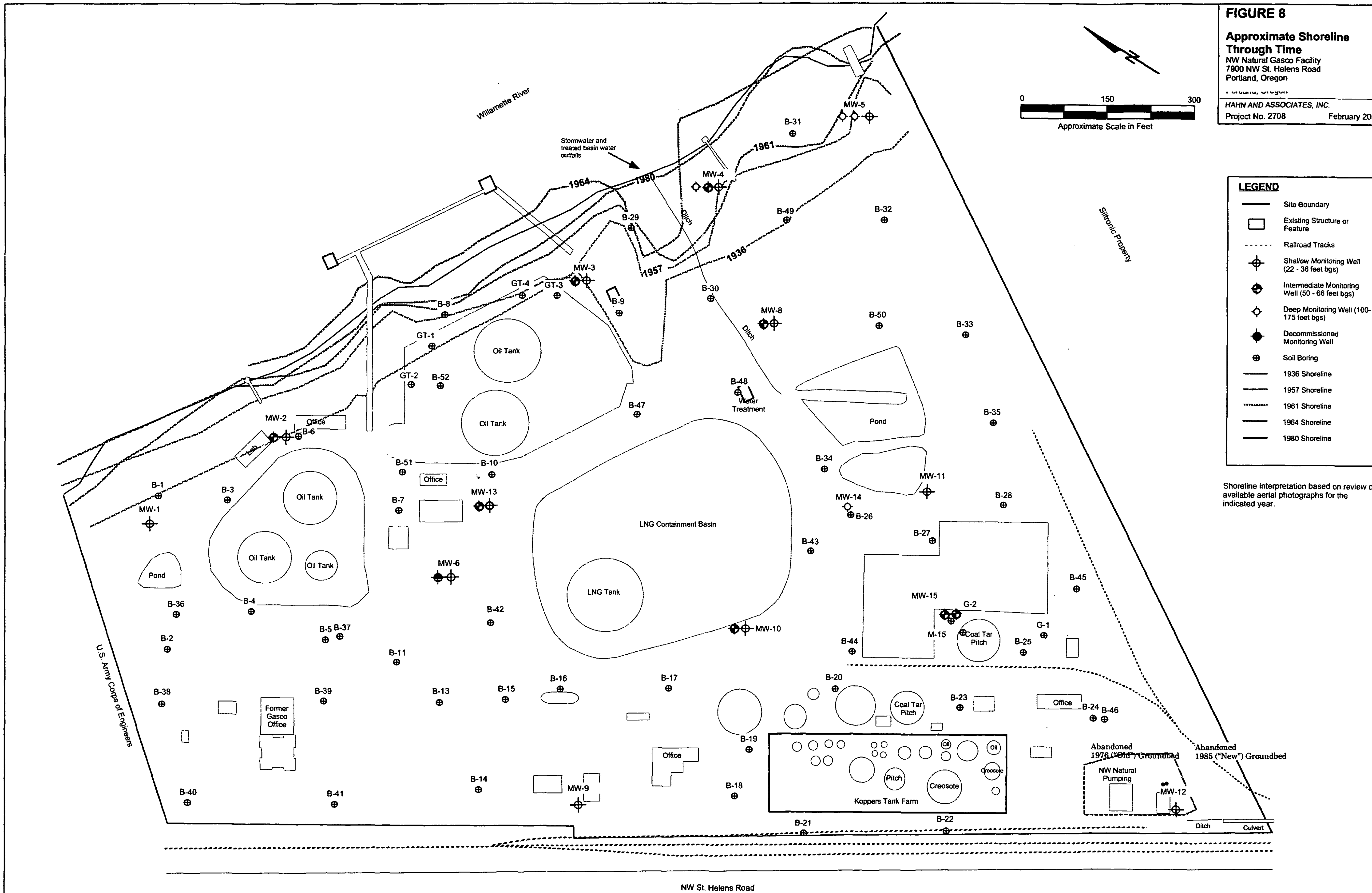


FIGURE 8
Approximate Shoreline Through Time
NW Natural Gasco Facility
7900 NW St. Helens Road
Portland, Oregon
HAHN AND ASSOCIATES, INC.
Project No. 2708
February 2004
0
150
300
Approximate Scale in Feet
LEGEND
Site Boundary
Existing Structure or Feature
Railroad Tracks
Shallow Monitoring Well (22 - 36 feet bgs)
Intermediate Monitoring Well (50 - 66 feet bgs)
Deep Monitoring Well (100-175 feet bgs)
Decommissioned Monitoring Well
Soil Boring
1936 Shoreline
1957 Shoreline
1961 Shoreline
1964 Shoreline
1980 Shoreline
Shoreline interpretation based on review of available aerial photographs for the indicated year.
Willamette River
Stormwater and treated basin water outfalls
Siltronic Property
U.S. Army Corps of Engineers
NW St. Helens Road
1936
1957
1961
1964
1980
Ditch
Oil Tank
LNG Containment Basin
LNG Tank
Water Treatment
Pond
Office
Lab
Former Gasco Office
Coal Tar Pitch
Koppers Tank Farm
Pitch
Creosote
Oil
NW Natural Pumping
Abandoned 1976 ("Old") Groundbed
Abandoned 1985 ("New") Groundbed
Culvert
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-8
MW-9
MW-10
MW-11
MW-12
MW-13
MW-14
MW-15
M-15
GT-1
GT-2
GT-3
GT-4
G-1
G-2

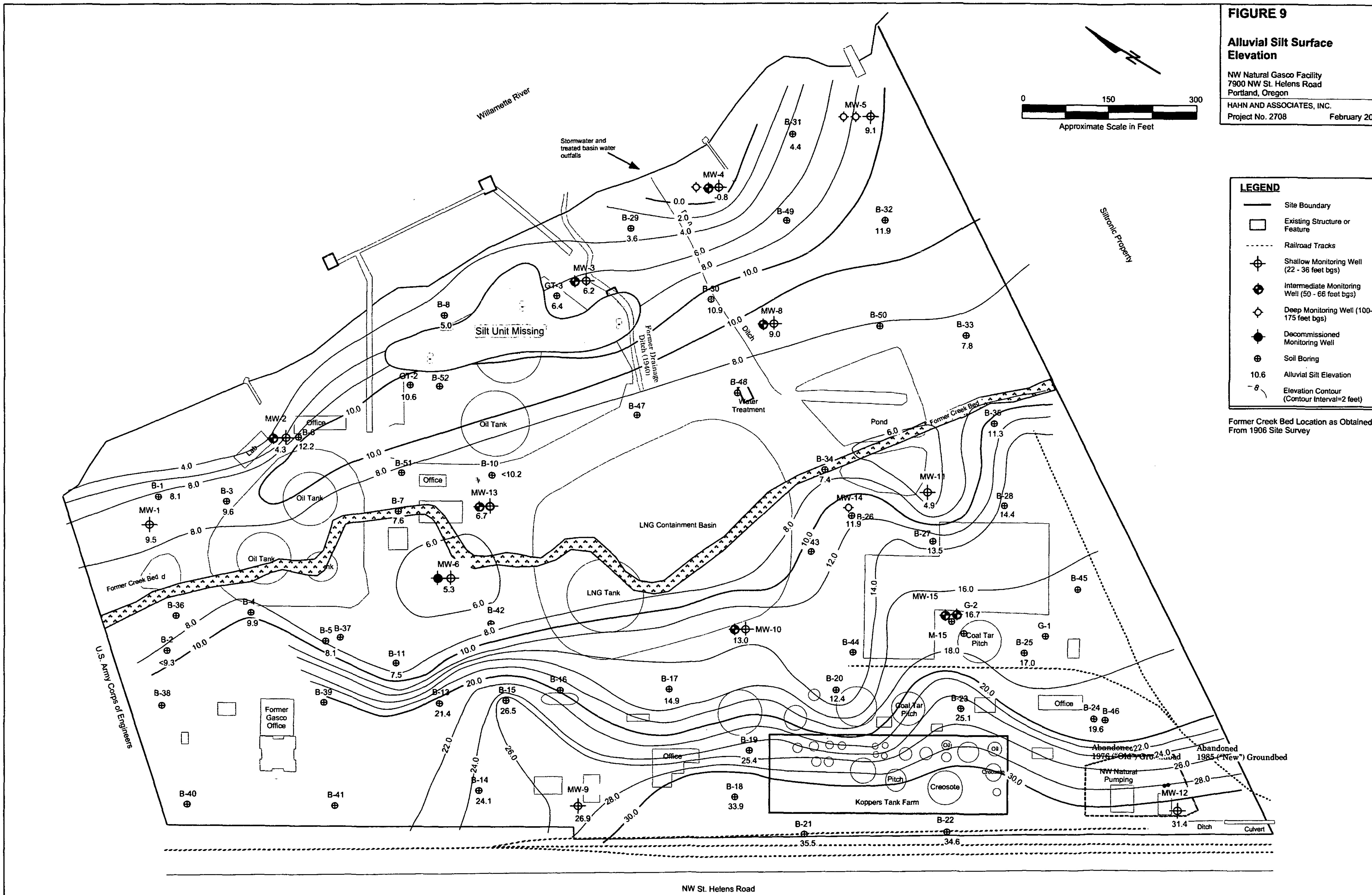


FIGURE 9
Alluvial Silt Surface Elevation
NW Natural Gasco Facility
7900 NW St. Helens Road
Portland, Oregon
HAHN AND ASSOCIATES, INC.
Project No. 2708
February 2004
0
150
300
Approximate Scale in Feet
LEGEND
Site Boundary
Existing Structure or Feature
Railroad Tracks
Shallow Monitoring Well (22 - 36 feet bgs)
Intermediate Monitoring Well (50 - 66 feet bgs)
Deep Monitoring Well (100-175 feet bgs)
Decommissioned Monitoring Well
Soil Boring
10.6 Alluvial Silt Elevation
Elevation Contour (Contour Interval=2 feet)
Former Creek Bed Location as Obtained From 1906 Site Survey
Willamette River
Stormwater and treated basin water outfalls
Siltronic Property
U.S. Army Corps of Engineers
NW St. Helens Road
Silt Unit Missing
Former Drainage Ditch (1940)
Ditch
Water Treatment
Pond
Former Creek Bed
Oil Tank
Office
Lab
LNG Containment Basin
LNG Tank
Coal Tar Pitch
Former Gasco Office
Koppers Tank Farm
Pitch
Creosote
Oil
Abandoned 1976 ("Old") Groundbed
Abandoned 1985 ("New") Groundbed
NW Natural Pumping
Culvert
MW-1 9.5
MW-2 4.3
MW-3 6.2
MW-4 -0.8
MW-5 9.1
MW-6 5.3
MW-8 9.0
MW-9 26.9
MW-10 13.0
MW-11 4.9
MW-12 31.4
MW-13 6.7
MW-14
MW-15
G-1
G-2 16.7
GT-2 10.6
GT-3 6.4
B-1 8.1
B-2 <9.3
B-3 9.6
B-4 9.9
B-5 8.1
B-6 12.2
B-7 7.6
B-8 5.0
B-10 <10.2
B-11 7.5
B-13 21.4
B-14 24.1
B-15 26.5
B-16
B-17 14.9
B-18 33.9
B-19 25.4
B-20 12.4
B-21 35.5
B-22 34.6
B-23 25.1
B-24 19.6
B-25 17.0
B-26 11.9
B-27 13.5
B-28 14.4
B-29 3.6
B-30 10.9
B-31 4.4
B-32 11.9
B-33 7.8
B-34 7.4
B-35 11.3
B-36
B-37
B-38
B-39
B-40
B-41
B-42
B-43
B-44
B-45
B-46
B-47
B-48
B-49
B-50
B-51
B-52
M-15 18.0

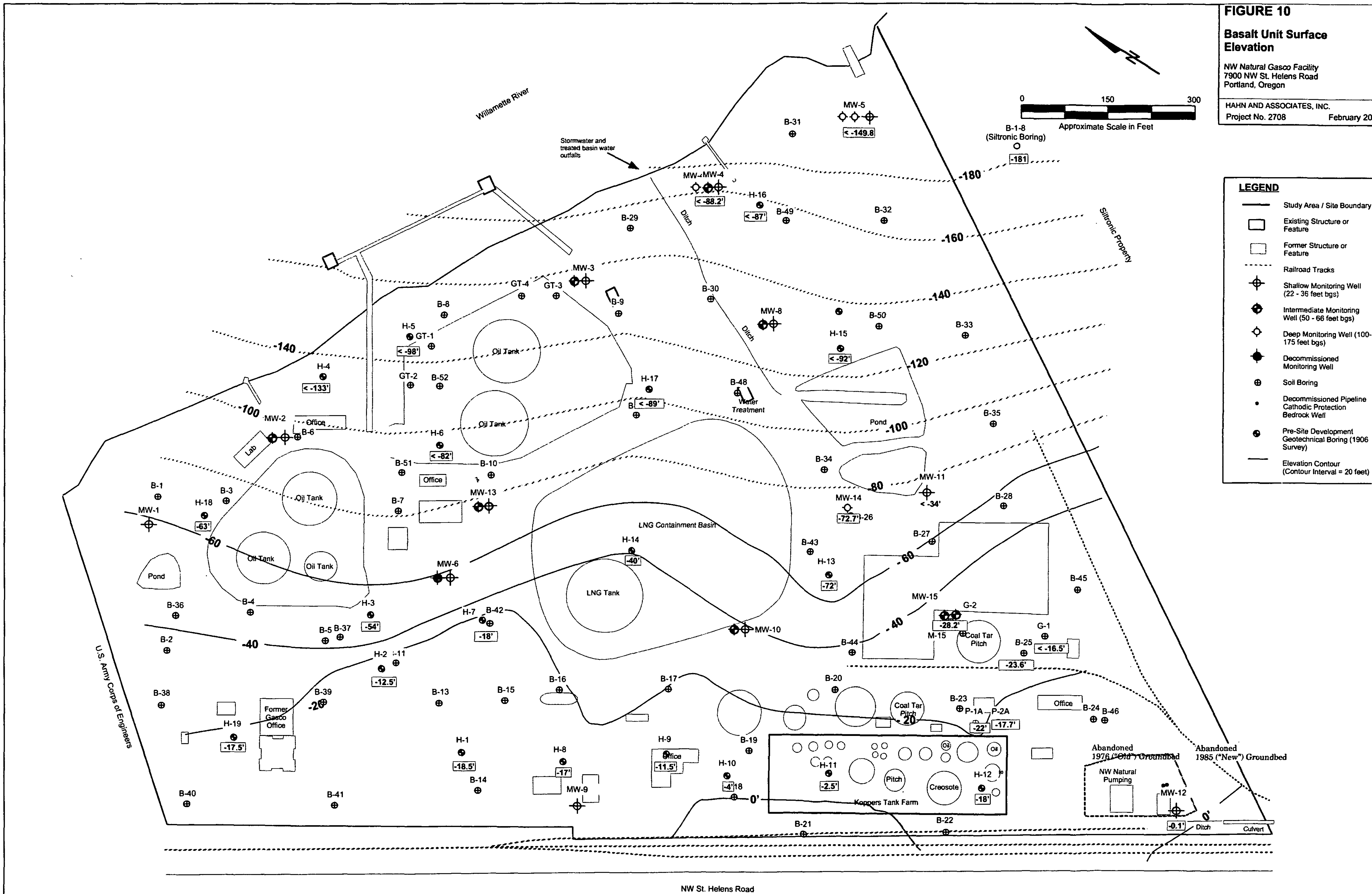


FIGURE 10

Basalt Unit Surface Elevation

NW Natural Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
Project No. 2708 February 2004

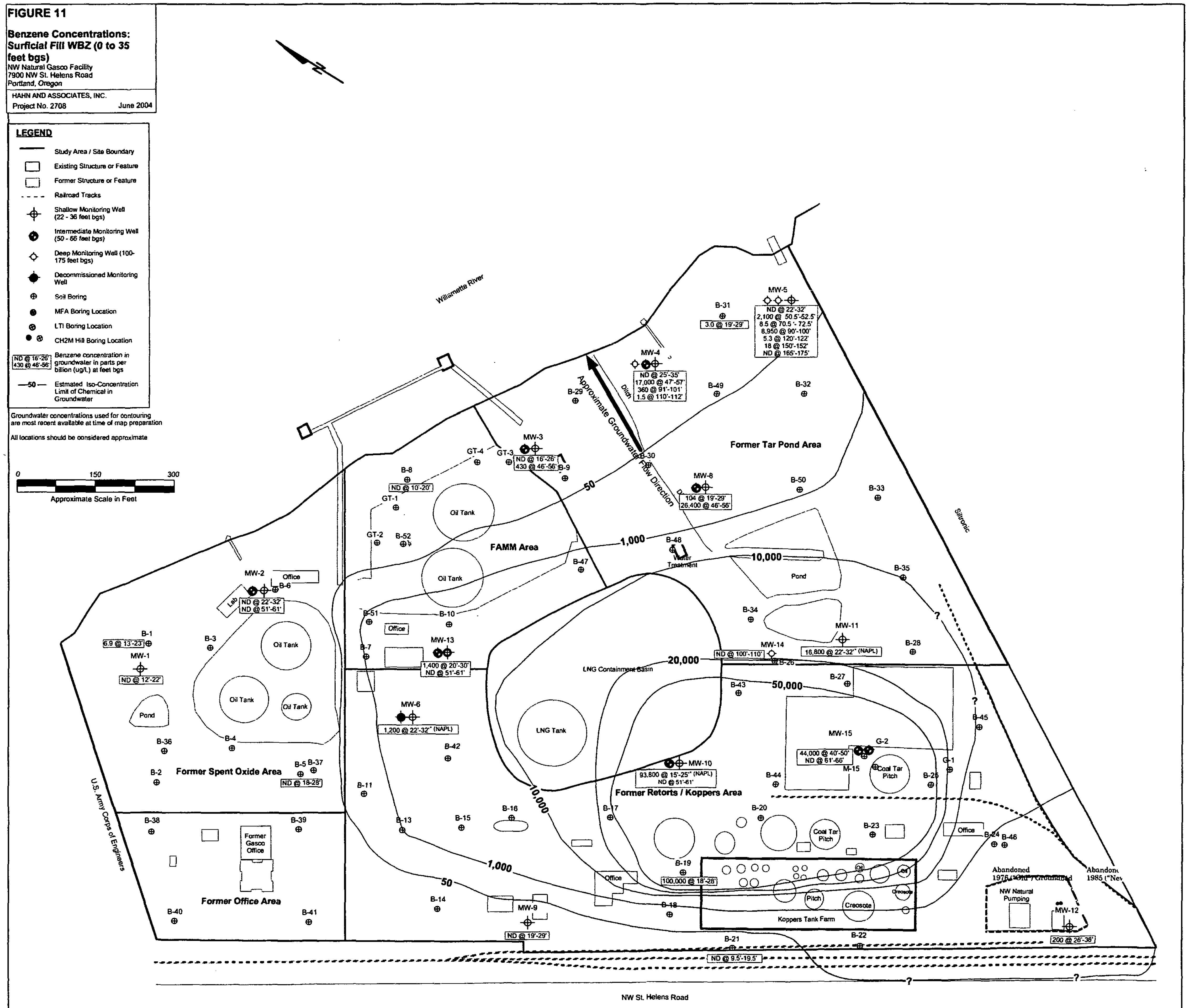


FIGURE 11

Benzene Concentrations: Surficial Fill WBZ (0 to 35 feet bgs)

NW Natural Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
Project No. 2708 June 2004

FIGURE 12

Benzene Concentrations: Alluvial WBZ (50 to 125 feet bgs)

NW Natural Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
Project No. 2708 June 2004

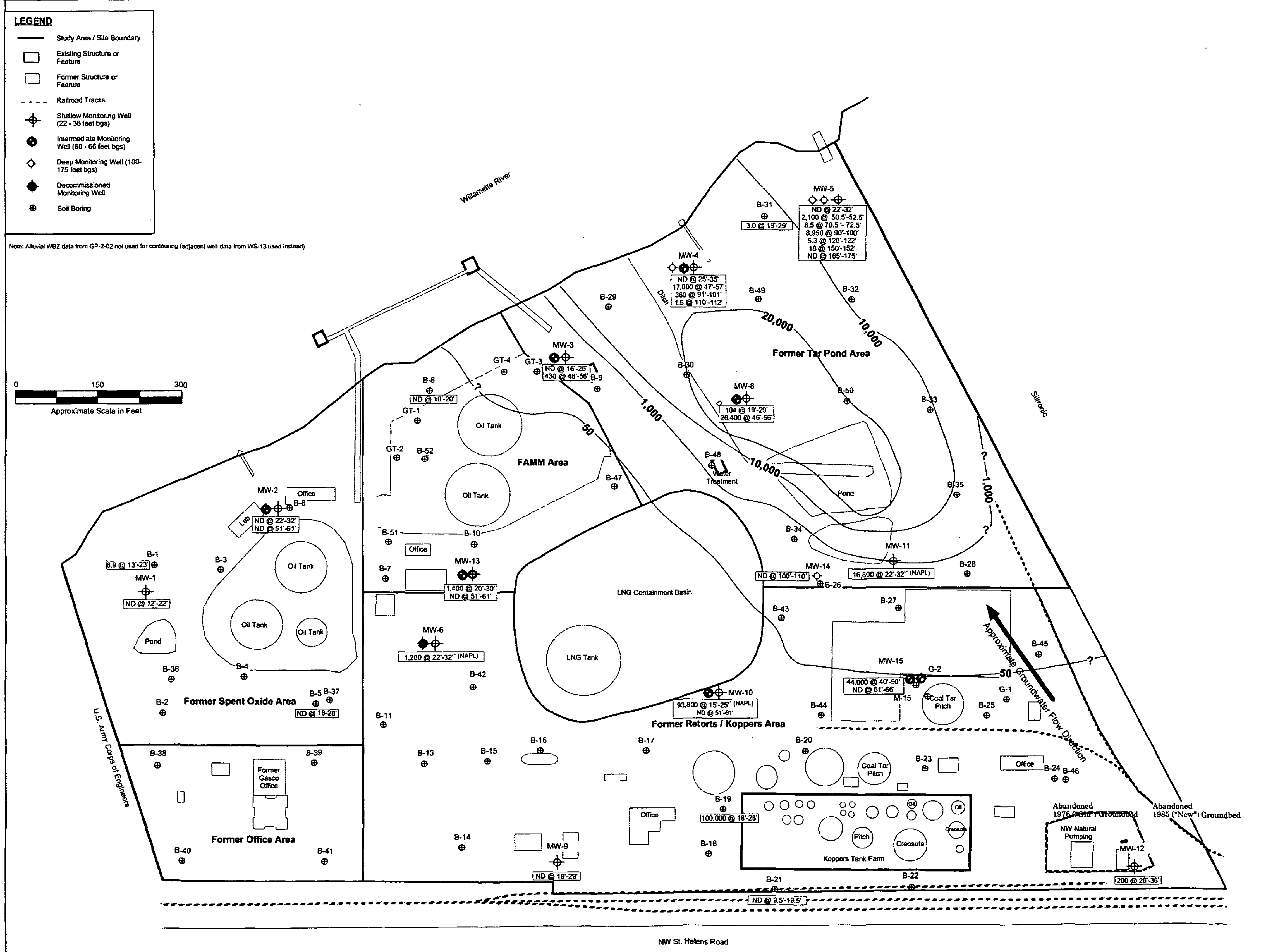


FIGURE 13

Naphthalene Concentrations: Surficial Fill WBZ (0 to 35 feet bgs)

NW Natural Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
Project No. 2708 June 2004

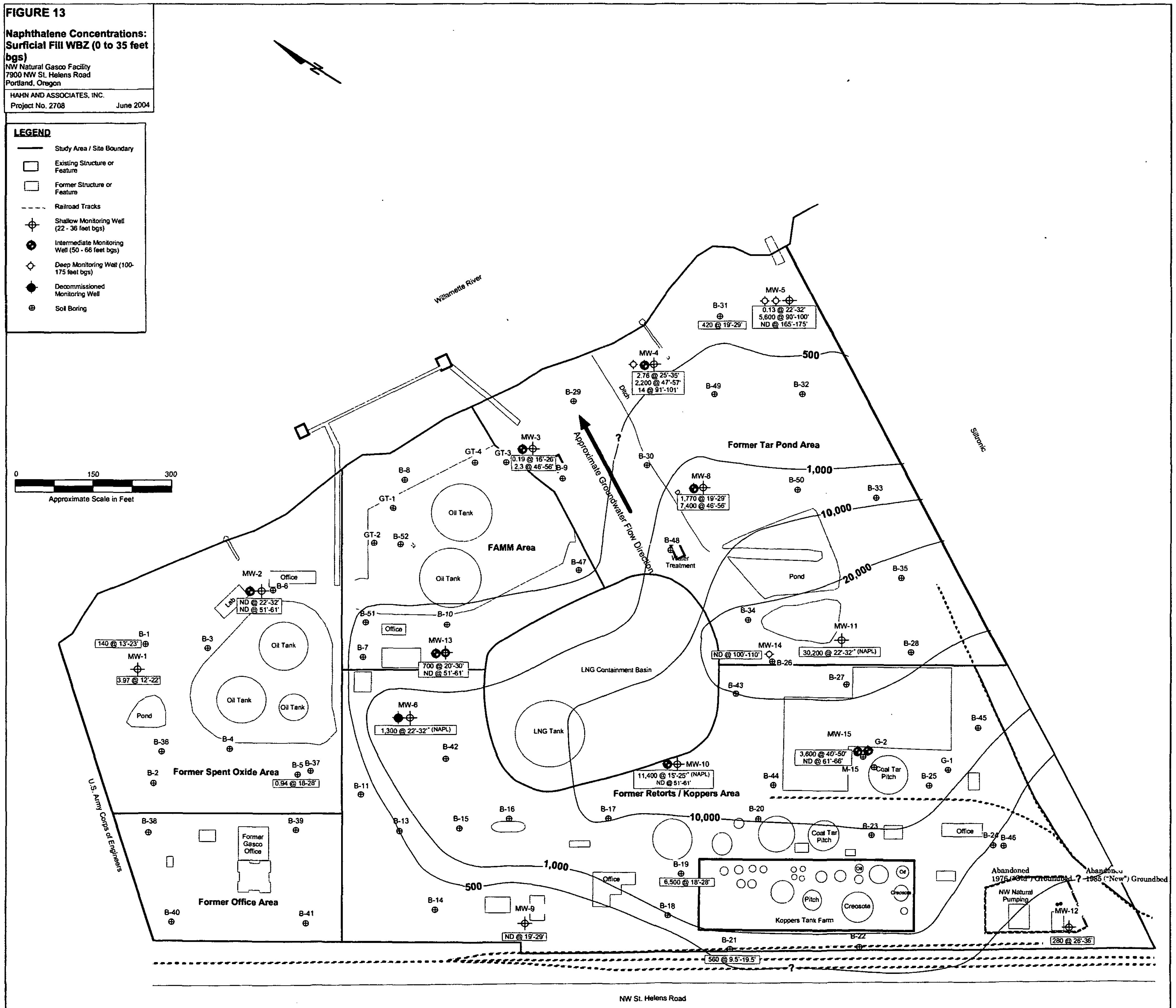
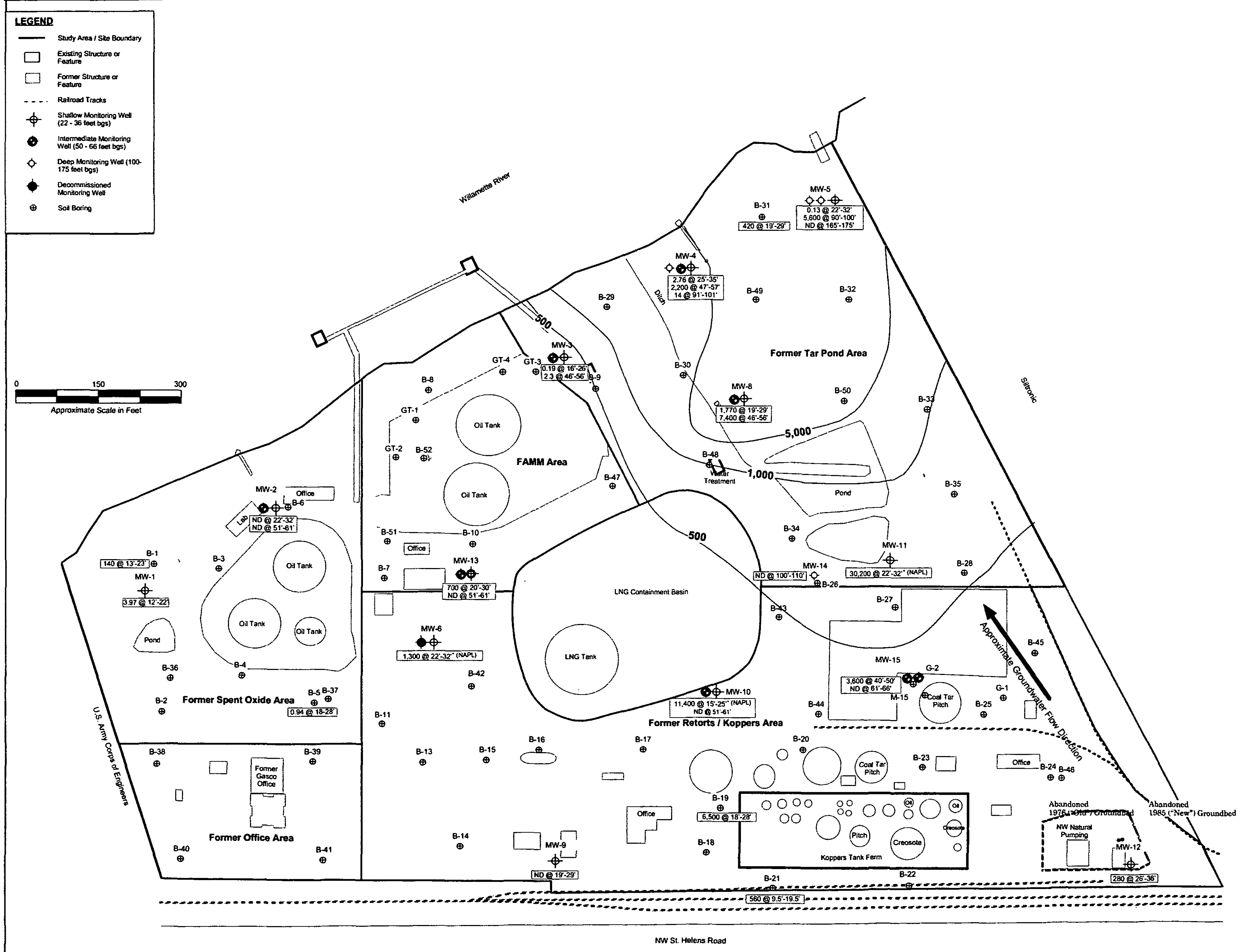
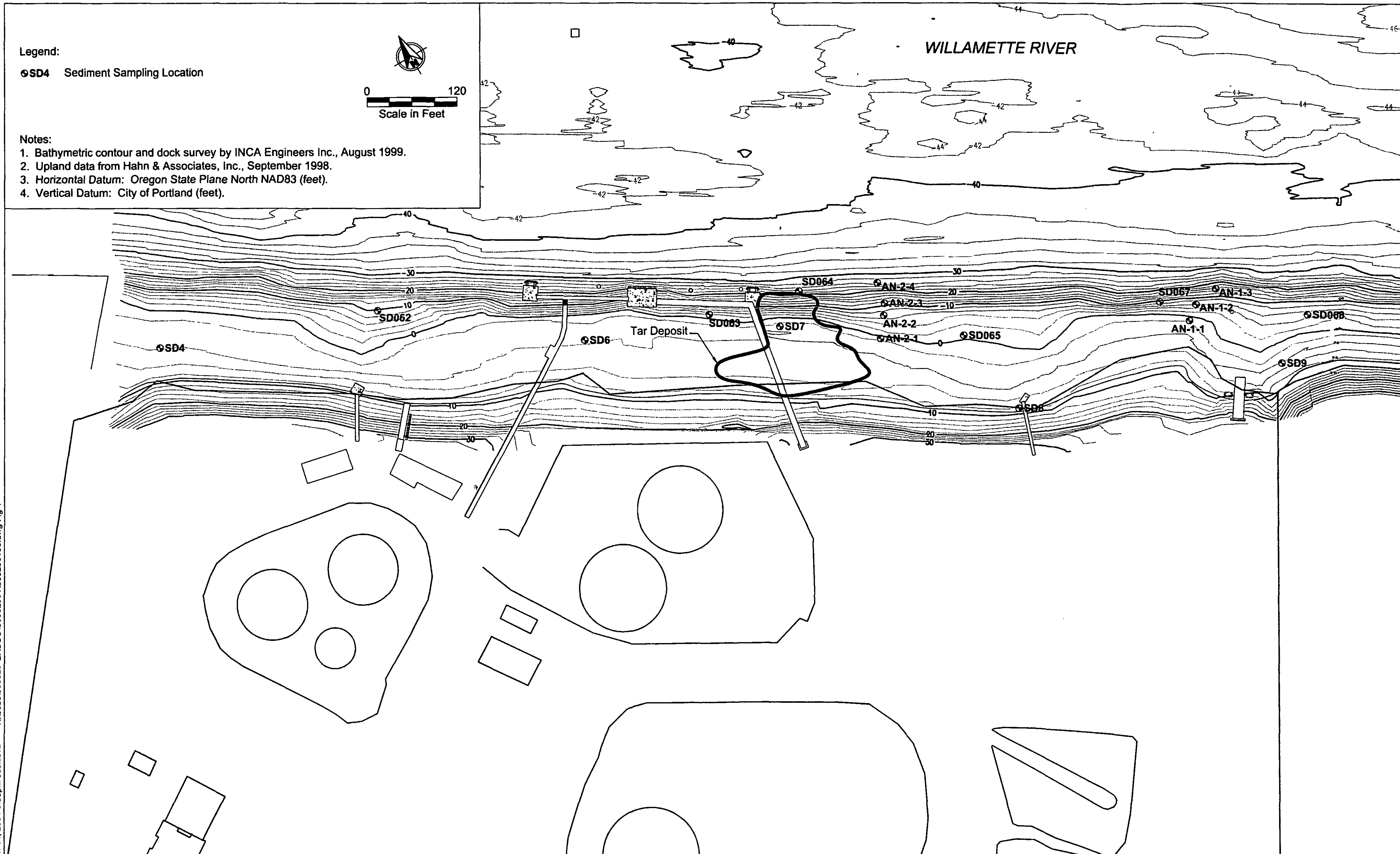


FIGURE 14
Naphthalene Concentrations: Alluvial WBZ (50 to 125 feet bgs)
NW Natural Gasco Facility
7900 NW St. Helens Road
Portland, Oregon
Portland, Oregon

HAHN AND ASSOCIATES, INC.
Project No. 2708 June 2004





Jun 14, 2004 3:05pm sdekleva K:\Jobs\000029-GASCO\00002901\00290106.dwg Fig 1

ANCHOR ENVIRONMENTAL, L.L.C.

Figure xx
Sediment Sampling Locations
Northwest Natural "GASCO" Site

Appendix A-6

Gunderson

GUNDERSON, INC.
CSM Site Summary – Appendix A-6

GUNDERSON, INC.

Oregon DEQ ECSI #: 1155

4350 NW Front Avenue
DEQ Site Mgr: Dana Bayuk
Latitude: 45.5551°
Longitude: -122.7202°
Township/Range/Section: 1N/1E/20

River Mile: 8.5 to 9.2 West bank

LWG Member ☒ Yes ☐ No

Upland Analytical Data Status: ☒ Electronic Data Available ☐ Hardcopies only

1. SUMMARY OF POTENTIAL CONTAMINANT TRANSPORT PATHWAYS TO THE RIVER

The current understanding of the transport mechanism of contaminants from the uplands portions of the site to the river is summarized in this section and Table 1 and supported in following sections. In all DEQ documents, the site is, artificially divided into Areas 1, 2, and 3, with Area 1 being the farthest downstream.

1.1. Overland Transport

The Gunderson Facility is located on the southern floodplain of the Willamette River (refer, Figure 1). The elevation of the site is variable, and ranges from approximately 40 feet above mean sea level (msl) in the northwest area of the site (Area 1) to approximately 30 feet msl in the southeastern area of the site (Area 3). The site itself is relatively flat with buildings, asphalt pavement, railroad spurs, and parking lots, covering approximately 85 percent of the property. The balance of the site consists of open ground and gravel-covered roadways.

The area surrounding the site is generally flat with steep river banks sloping north-northeast towards the Willamette River. There are no aquatic resources, ponds, or surface streams located on the site. Surface water temporarily exists on the site as storm water, which, flows generally towards the northeast, and primarily into the Willamette River via a drainage network of catch basins and outfalls or directly infiltrates into the subsurface. Accordingly, overland transport of contaminants entrained in storm water is minimal. There are 24 identified storm water outfalls that drain the site, all of which are equipped with oil/water separators (refer, Figures 2, 3, and 4). The drainage outfalls release the storm water to the Willamette River. Some minor amount of stormwater near the bank discharges overland to the Willamette River. Much of the storm water from offsite sources to the west flows across the site through a drainage culvert (BES Willamette Outfall #18) located below the on-site drainage areas.

1.2. Riverbank Erosion

The Gunderson facility's Willamette River bank is predominantly armored with rip-rap (small to large imported boulders). This feature effectively reduces erosion. In a few areas with little or no rip-rap, native and non-native vegetation has taken hold. The vegetation typically consists of grasses, Himalayan blackberries, butterfly bushes, and Pacific willows. A large outfitting dock with gantry extends into the river in the upstream portion of the site, further sheltering the bank from erosion.

1.3. Groundwater

Site-specific information indicates that the surficial, shallow sand / silt unit located on the site forms an interconnected, heterogenous, anisotropic aquifer. The shallow ground water table varies in depth from approximately 7 feet to 25 feet below the ground surface (bgs), and it appears that this water-bearing unit exists under unconfined conditions. However, locally confined conditions could exist within the water-bearing unit. Perched water table conditions have been identified in discrete, limited areas of the Gunderson facility.

The depth to the water table for the facility varies seasonally (refer, Figure 5). The rate and regional ground water flow direction are a function of water levels and the hydraulic conductivity of the subsurface, but generally slope to the northeast towards the Willamette River. Recharge occurs primarily from offsite sources but also includes recharge by rainfall in the limited areas without impervious cover. Previous studies indicate that the shallow ground water zone is strongly influenced by the river. The shallowest ground water zone, the non-continuous perched system that is variable throughout the site, does not appear to be influenced by the river.

Ground water flow is predominantly towards the Willamette River (refer, Figure 6), but ground water mounds have been observed in some portions of the site. These mounds have been attributed to perched water tables formed by buried anthropogenic features or differences in permeability between alluvial deposit and artificial fill sediments. Groundwater discharge to the Willamette River occurs below the mean low water line. One seep (Seep-01) has been identified near the southeast corner of the site (Area 3).

1.4. Direct Discharge *(Overwater Activities and Stormwater/Wastewater Systems)*

The application of coatings for the marine barges does take place in overwater conditions on an intermittent basis. Engineering controls (tarps) are used to keep blast media from going into the river when blasting activities are conducted in overwater conditions. In addition, completed railcars are temporarily staged on an outfitting dock for re-work of welds, touch-up painting, and using a transit to make sure cars are level.

There are 24 storm water outfalls to the Willamette River, including 35 oil/water separators. These outfalls are distributed northwest to southeast throughout the site. For reference, the outfalls have been numbered OF-1 though OF-24 (see supplemental Table 2 for respective City of Portland outfall nomenclature) and the oil / water separators were originally numbered OWS-1 through OWS-12, OWS-15 and LOWS-1 through LOWS-11. Each catch basin and oil / water separator is equipped with a geotextile fabric "basket" installed beneath the inlet to the catch basin. These "baskets" trap sediment but permit the flow of water. Some of the "baskets" are modified with an oil absorbent polymer to trap oil and grease.

A groundwater extraction and treatment system (ETS) is being installed to remediate groundwater in the northern portion of the site. The treated groundwater will be directly discharged to the Willamette River. Other facility wastewater is placed directly into the City of Portland sanitary sewer system and removed from the facility. No onsite wastewater disposal is conducted on the facility.

1.5. Relationship of Upland Sources to River Sediments

See Final CSM Update.

1.6. Sediment Transport

The Gunderson property is located along the west side of the river from approximately RM 8.5 to

This document currently under review by US EPA and its federal, state and tribal partners, and is subject to change in whole or part.

9.2. The river in this area is widening and the offshore channel environment is depositional based on the site physical information compiled in the Programmatic Work Plan (Integral et al. 2004). The Sediment Trend Analysis® results suggest that that the nearshore area off of this site is depositional at the upstream end of the property and then transitions to dynamic equilibrium (i.e., sediment moving into and out of the area without a net loss or gain) downstream. The STA® data indicate that the offshore center and eastern portion of the reach is depositional along the entire length of the site. The time-series bathymetric change data over the 24-month period from January 2002 through February 2004 (Integral and DEA 2004, in prep) support the STA® results and show a large net sediment accumulation area (up to 2+ ft in extent) from the 0 to the –35 ft NAVD88 contour off of the upstream end of the site. In contrast, the nearshore area above the –20 ft NAVD88 contour along the middle and downstream portion of the site (including the Shell/Texaco Equilon dock) shows either no change or small-scale sediment erosion. In this area, net sediment accumulation is evident offshore, i.e., beyond the –25 ft out to the –40 ft NAVD88 contour. Periodic monitoring from July 2002 to January 2004 of beach stakes set in the middle of the Gunderson area (at the Shell/Texaco Equilon site) at elevations of +7, +9, and +14 ft (NAVD88) show variable results (Anchor 2004). The low stake, +7, shows net erosion of about 18 cm over the measurement period; this is consistent with the nearshore bathymetric change data. The middle stake, +9, showed two cycles of sediment accretion (up to 20 cm) in the summer/fall followed by erosion back to the baseline level in the winter/spring periods. The high stake, +14, showed little change through December 2002 and then small-scale erosion (8 cm) through the remainder of the observation period (to January 2004).

2. CSM SITE SUMMARY REVISIONS

Date of Last Revision: September 15, 2004

3. PROJECT STATUS

[Primary Source: ECSI file and DEQ Staff Report]

Activity		Date(s)/Comments
Site Investigation	☒	Various activities between 1991 and 1998
PA/XPA	☒	Area 1 = 1993-94 (equiv) // Area 2 = 2002 – 2004 Area 3 = 2000 - 2002
RI	☒	Area 1 = 1994 // Area 2 = In Progress Area 3 = September 2004 (In Progress)
FS	☒	Area 1 = 1994
Interim Action/Source Control	☒	Area 1 = 2004
ROD	☐	
RD/RA	☐	
NFA	☐	

DEQ Portland Harbor Site Ranking (Tier 1, 2, or 3): 1

4. SITE OWNER HISTORY

[Primary Source: ECSI file, RI reports, site investigation reports, and DEQ Staff Report.]

Owner/Occupant	Type of Operation	Years
Gunderson, Inc.	Manufacturing – rail cars and marine barges	1984 - present
FMC Corporation	Manufacturing – rail cars and marine vessels	1965 – 1984 (Area 3 – 1979-1984)
Schnitzer / American Ship Dismantlers (Area 3)	Ship dismantling and auto salvage	1960 - 1979
Gunderson Brothers Engineering Corporation (Areas 1 and 2)	Manufacturing – rail cars, marine barges, landing craft, engineered steel components, and specialty parts for marine vessels	1942 (?) - 1965

5. PROPERTY DESCRIPTION

The Gunderson facility is located in the northwest portion of the City of Portland, Multnomah County, Oregon. The facility location is situated along the western banks of the Willamette River within the Portland Basin. The facility location is generally flat but does drop steeply to the Willamette River along its northeast and east boundary.

The Gunderson facility property is bounded on the northeast by the Willamette River, southwest by N.W. Front Avenue and the Burlington Northern Railroad yard, Lakeside Industries to the northwest, and James River Corporation to the southeast, and on the southwest by NW Front Avenue. The Burlington Northern Railroad's Lake Yard is located on the opposite side of NW Front Avenue. Gunderson owns to the mean high water line and leases its docks and ways from the Oregon Division of State Lands.

The general area surrounding the facility is zoned Heavy Industrial and River Industrial, characterized by sparse population and few residential sites within 0.5-mile of the site. Areas 1 and 2 of the facility are on a tax lot approximately 64 acres in size. Due to the size of the facility, Area 1 has been designated for the northwestern portion (north ½ of Tax Lot 50) and Area 2 has been designated for the central portion (south ½ of Tax Lot 50). The address 4700 NW Front Avenue is occasionally applied to Area 1, whereas, the address 4350 NW Front Avenue applies to Area 2 or is used to designate the complete facility. Gunderson's Area 3 is located at 4250 NW Front Avenue and consists of one tax lot (Tax Lot 57). The tax lot is generally rectangular in shape and includes about 20 acres.

Area 1, located at the northwestern section of the plant is where shipping and receiving operations are conducted and raw materials are stored in warehouses and open storage space prior to preparation for assembly. The rail car assembly process is also initiated in Area 1.

Small quantities of solvents and lubricants are present in the Machine Shop and Quonset Hut. Both of these sections are covered and protected by asphalt or concrete. Historically, a 1,1,1-trichloroethane (TCA) above ground storage tank (AST) and Dip Tank were present in Area 1, near the western corner of the Demount Building. Three underground storage tanks (USTs) were decommissioned by removal in 1991. The three USTs included two 1,000-gallon capacity and a 6,000-gallon capacity tanks for motor fuel storage. In addition, a buried 1,000-gallon propane tank was discovered and decommissioned by removal in 2004.

Area 2 is the central section of the plant where most of the industrial operations are located. The assembly and fabrication of railcars and marine barges, including finishing and painting operations, are located primarily in Area 2. Included in Area 2 are the Administration and Engineering Offices, maintenance shops, covered craneways, a launch site for marine barges, painting, stenciling and railcar finishing areas, and fabrication bays.

Near the center of Area 2 is the dock and easement owned and operated by Shell Oil (formerly Texaco) doing business as Equilon Enterprises Limited Liability Company (LLC), an international distributor of petroleum products. Equilon's easement contains a number of underground pipelines that traverse underneath the site and deliver petroleum products to and from their bulk distribution terminal, located approximately 0.4 miles to the southwest. Equilon has placed a vapor extraction system in their easement, near the easement's juncture with N.W. Front Avenue.

Gunderson's Area 3, also known as the Former Schnitzer Steel Yard is a large open area currently used by Gunderson primarily as a storage yard. A number of railroad tracks traverse this area to facilitate storage. Also located in Area 3 are the Autostack Building and the Hazardous Materials Storage Area. Other structures in Area 3 include the 3-Bay Building, Stevedore Building, Scale House Building, and a dock (gantry) facility.

The Burlington Northern Santa Fe Railroad's Lake Yard, located to the southwest, consists of numerous railroad tracks. Six catch basins, for storm water runoff from the Lake Yard, are situated along Front Avenue. Drainage from these basins is routed to a 4-foot culvert that discharges directly into the Willamette River.

6. CURRENT SITE USE

Gunderson, Inc. is an active industrial facility that manufactures and refurbishes railroad cars and marine barges. The Gunderson manufacturing operation is categorized under Standard Industrial Classification (SIC) Code 3743: Railroad Equipment, and SIC Code 3731: Ship Building and Repairing.

Area 1, located at the northwestern section of the plant is where shipping and receiving operations are directed by the Material Control Office, and raw materials are stored in warehouses and open storage space prior to preparation for assembly. The assembly process is initiated in the Machine Shop, Plate Shop, and Demount Building of Area 1 but predominantly conducted in Area 2. The predominant site use in Area 2 is for the manufacturing, painting, and assembly of railcars and parts. The Fabrication Bays of the Assembly Area house relatively few hazardous materials including hydraulic oil and primers.

Bag House # 1 is located in the north central section of the Assembly Area. Next to Bag House # 1 is the railcar end primer booth. The railcar end primer booth contains a "paint kitchen", blast area, and paint area. Water based primers are used and stored in this location. The system includes a water-based paint extraction system that helps remove excess primer from the surroundings. The blasting operation uses copper slag for blasting. Machinery used to press and shape parts produced in this area are operated by use of electricity and hydraulic oil.

Adjoining the Assembly Area is the Craneway Area, which consists of a large linear building housing several overhead cranes, used for the preliminary manufacturing operations of rail cars and marine barges. Included in the Craneway Area are plasma arc tables and five large water tanks used for metal cutting operations. There is also a railcar primer booth and blast area located in the Craneway 1 Building. Bag House # 2 is located on the riverside of the Craneway 1 building. Bag House # 2 reduces particulates in the air of the Craneway 1 building in the vicinity of the railcar side primer booth. Primer contains VOCs, particularly 2-butanone (also known as methyl ethyl ketone or MEK) and 4-methyl-2-pentanone (also known as methyl isobutyl ketone or MIBK). The particulates are filtered from the air and dispensed into bags at the bottom of the bag house. Particulates include copper slag and other solids used in the blasting process.

Primers are used and stored in the open area between the Fabrication Bays / Craneways. The railcar side primer booth uses a water-based paint extraction system that helps remove excess primer from the painting booth. Hydraulic oil is used in the operation of power machinery in this area. According to Gunderson staff, all capacitors and vaults in Area 2 are free of PCBs. Acids are used in supplemental operations conducted in the compressor room. Metals accumulate around the cutting areas and are transported to recycling centers.

This document currently under review by US EPA and its federal, state and tribal partners, and is subject to change in whole or part.

Adjoining the Fabrication Bays and west of the Craneways (further from the river) is the Finishing and Paint Building. This is the building currently used for painting, stenciling and finishing railcars. An existing vapor extraction system in this area is currently addressing a release of aromatic solvents (toluene) from a decommissioned in-place 3,000-gallon UST and historic surface actions. Other potential sources in this area are outlined below:

- The Paint Kitchen is comprised of a system of pumps that furnish paint to the paint room. Paint drums and containers are located in this area. Benzene, toluene, and MEK are used in some solvent-based paints. However, almost all of the paint currently used at the Gunderson facility is water based.
- The Epoxy Day Tank Room contains two day tanks which supply epoxy enamel paint as needed. The tanks hold the two separate parts of the epoxy finish.
- The Stencil Wash Room contains a holding tank, cooker, and distiller system that purifies solvents for reuse in the stencil wash system. Toluene is the primary solvent used in this system and drums of toluene are stored in this room.
- The Separator is a system that separates used sandblast sands or "grit" from debris. Sandblast sand used in the blasting operation is composed of a copper slag.
- Bag House # 4 filters particulates from within the paint and blast areas, which end-up deposited in bags below the system. Particulates include copper slag and other air borne particles.

Marine barges are also constructed in Area 2, an activity that has been undertaken in this area since at least the 1960's. The Marine Barge Area is located on the Willamette River, in the upstream end of Area 2, east of the Craneways Building. Metal frames and plates are cut for the barges. Painting and sand blasting also occur in the Marine Paint Booth and in the barge construction area. Paints and primers are temporarily stored and used in this area. Bag House # 3 is located just outside the Marine Paint Booth. A decommissioned in place UST is also located adjacent to Bag House # 3.

West of the Craneways Building and the Marine Barge Area, adjoining NW Front Avenue, is Gunderson's Administration / Engineering / Maintenance Building. The portion of this building dedicated to maintenance is the current location of Gunderson's Oil Storage and Recycling Area. The Oil Storage and Recycling Area houses hydraulic oils, bulk motor oils, transmission fluid, and waste oil. A 300-gallon hydraulic oil above ground storage tank (AST), a 125-gallon 30 weight motor oil AST, and a 300-gallon waste oil AST are located in the oil recycling area. Several drums and buckets containing oils and transmission fluid are also in this area. A parts cleaning station using ZEP solution parts cleaning solvent is located in the maintenance building. Two 2,000-gallon ASTs holding petroleum products (one for gasoline and one for diesel) are located in the east end of this area. A liquid nitrogen tank is also located in this end.

Gunderson's Area 3 is a large open area currently used as a storage yard. A number or railroad tracks traverse the site to facilitate the movement and storage of finished railcars. Also located in Area 3 is the Hazardous Materials Storage Area, the Autostack Building, the 3-Bay Building, the Stevedore Building, Scale House Building, and a dock (gantry) facility

7. SITE USE HISTORY

Based on previously conducted research, the history of the facility from 1913 to the present has been documented. Maps obtained from the Commission of Public Docks for 1913 and by the Public Works Department for 1919 show the presence of the ancestral (or possibly the same current one) Equilon Dock, but do not exhibit buildings or other developments on the site, which was essentially under water at that time. A 1932 Sanborn Fire Insurance Map indicates the presence of a bulk petroleum facility (currently

Equilon's) on St. Helens Road, but it also does not show development on the current Gunderson facility site. The dock, but no building structures, is confirmed in a 1936 aerial photograph.

According to a 1942 Sanborn Fire Insurance Map, the Gunderson Brothers Engineering Corporation occupied the facility site at that time. Gunderson Brothers Engineering Corporation is not affiliated with Gunderson, Inc. Gunderson, Inc. was formed on November 27, 1984. The 1942 Gunderson Brothers' facility was only in Area 1, with three small buildings northwest of the Demount Building and the Quonset Hut south of the railroad line during this time. According to the Sanborn Map, the 1942 facility and the Quonset Hut were used for steel fabrication. The three smaller buildings were used as a truck repair shop, paint room, and offices. Two tanks, not specified as USTs or ASTs, were indicated adjacent to the main gate; listed as 4700 N.W. Front Avenue. Aerial photographs of the 1948 Vanport flood indicate the presence of the same buildings as in the 1942 Sanborn map. No development of Area 2 was apparent in the 1936, 1948, and 1951 aerial photographs.

Gunderson Brothers Engineering Corporation, Wheel and Rim Service, is listed in the 1943/44 Polk's Portland City Directory at 4700 N.W. Front Avenue. Gunderson Brothers Engineering Corporation is also listed at 4700 N.W. Front Avenue in the 1950 Polk's Portland City Directory. The 1955 Polk's Portland City Directory lists Gunderson Brothers Engineering Corporation at 4700 N.W. Front Avenue, but also lists Strand Steel at 4701 N.W. Front Avenue. A series of photographs taken between 1953 and 1958 indicate that fill material was placed towards the Equilon Dock to raise Area 2 above the floodplain. Development in Area 2 is also evident in these photographs with the construction of the half of the Fabrication Bays north of the Equilon Easement almost complete by 1953. At that time the space between the Fabrication Bays and the Willamette River was used for parking and a launchways is apparent in Area 1. A 1955 aerial photograph indicates that additions to the Gunderson Brothers' facility extend the site up to the Equilon Dock. The first launchways in Area 2 appears in the 1957 photograph. By 1958, this launchways is covered and another adjacent covered launchways has been constructed. Fill appears to have been placed in part of the site with new building additions, plus to the southeast of the Equilon Dock to raise that area above the floodplain. The fill was apparently placed by the U.S. Army Corps of Engineers during Willamette River dredging operations.

The 1960 Polk's City Directory only lists Gunderson Brothers Engineering at 4700 N.W. Front Avenue. An aerial photograph taken in 1963 indicates that the Gunderson Brothers' facility had expanded to include the buildings that are presently Fabrication Bays 1 and 2, and the Second Car Line. Additionally, the Administration / Engineering / Maintenance building located at 4350 N.W. Front Avenue can be identified. Placement of the fill material appears to have been completed and the Willamette River shoreline is essentially similar to current conditions.

The 1970 Polk's Portland City Directory lists Gunderson Brothers Engineering, Controllers Department at 4350 N.W. Front Avenue and Gunderson Steel Fabricators and Gunderson Investment and Real Estate at 4700 N.W. Front Avenue. However, Gunderson Brothers had become a wholly owned subsidy of FMC Corporation, by merger, in 1965. By 1977, the Marine Barge Launch was developed in this area just upstream from the Equilon Dock. Other improvements noted in the 1977 aerial photograph include the construction of the Craneways Building, the two large whirly cranes on the Marine Barge Launchways, and the Finishing and Paint Building, which is connected to the Fabrication Bays by a Transfer Table.

FMC Corporation, Marine Engineering and Rail located at 4350 N.W. Front Avenue, and FMC Steel Fabricators at 4700 N.W. Front Avenue were identified as residing on the site, according to the 1980 - 1981 Polk's City Directory. In a 1983 aerial photograph, the two northernmost launchways (the first two for Area 2) are no longer visible.

Gunderson, Inc., located at 4350 N.W. Front Avenue and 4700 N.W. Front Avenue, was listed in the 1985 Polk's Portland City Directory. Businesses listed as occupants of the site in the 1987 Polk Portland City Directory, include Gunderson, Inc. and Gray's International of Oregon, Inc., Crane Rentals, at 4300

N.W. Front Avenue.

Area 3 remained a low-lying portion of the Willamette River's floodplain until the late 1950's and early 1960's. During this period the land was raised, beginning in the north and moving south, using hydraulic fill derived from the Willamette River by the U.S. Army Corps of Engineers.

During the 1960's, American Ship Dismantlers, a Schnitzer company, occupied the portion of the Gunderson facility currently referred to as Area 3. The existing outfitting dock is being constructed in an aerial photograph taken in 1963. The dock was initially used for ship dismantling activities. Later aerial photographs from 1964 and 1966 show the ship dismantling operations.

Schnitzer Steel converted their operations from ship dismantling to automobile demolition in the early 1970's. The automobile scrap yard was in operation at the site until 1979. The automobile salvage operations are evident in aerial photographs collected from 1973, 1977, and 1978. By 1983 FMC Corporation is the owner of the Area 3 property. The automobile salvage operations had apparently ceased, and the property had been graded flat. Gunderson, Inc. obtained all of the property, including Area 3, from FMC Corporation in 1984.

8. CURRENT AND HISTORIC SOURCES AND COPCS

The understanding of historic and current potential upland and overwater sources at the site is summarized in Table 1. The following sections provide a brief overview of the potential sources and COPCs at the site requiring additional discussion.

8.1. Uplands

A 1,1,1-trichloroethane (TCA) AST was formerly located near the Shipping and Receiving Gate (at 4700 NW Front Avenue- Area 1), specifically at the northwestern corner of the Demount Building. The TCA-containing above ground storage tank was a supply for a wheel and axle degreasing unit (dip tank) that was also once located in this area.

According to an employee working on the site, in May 1980, while the facility was owned and operated by FMC Corporation, a rail car axle was dropped, and it broke through the bottom of the degreasing unit (TCA dip tank) and a TCA spill occurred. It has been estimated that the tank held approximately 200 gallons of TCA, which spilled onto the asphalt and concrete paved area and flowed to the north, along a railroad track located east of the TCA dip tank. The TCA spill was intercepted in a concrete trench using an adsorbent to stop the flow prior to reaching the site drains. An environmental firm was hired to clean up the spill and dispose of the waste. The tank was removed in 1996 and Gunderson changed their axle degreasing process to use nonhazardous materials. The presence of TCA-contaminated soil should be considered a source.

In Area 2, the vicinity of the Rail Car Side Panel Paint Kitchen and Bag House #2 apparently has seen more hazardous materials use and storage during previous industrial operations from the late 1950s to the late 1970s. Some paints are currently stored in this area but evidence obtained during completion of the *Expanded Preliminary Assessment* (XPA) (January 2004) suggests that previous land use may have created a limited contaminant source. Specifically, aged gasoline and metals (specifically antimony, arsenic, copper, lead, manganese, and zinc) found in the ground water are associated with marine paints, but not rail car side panels. Marine barge construction was formerly conducted in this area.

The Marine Barge Paint and Blast Area has been active with sand and grit blasting of metal structures for over 20 years. The sampling in this vicinity was focused on three regimes: the blast grit collected on the ground surface around the Marine Paint and Blast Building, directly below outfall OF-13 (WR-138), and the subsurface (soil and ground water) in the location used

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for the temporary storage of marine paints. The blast grit was found to have concentrations of arsenic, chromium, copper, manganese, and zinc above the anticipated background concentrations. Butyl tins and aromatic VOCs were also detected in the blast grit.

Based on previous investigations, we have identified several potential sources in Area 3. The sources are listed below:

- Historical activities associated with the American Ship Dismantlers' activities, specifically the backfilling of an area referred to as the Access Gully and the general dissemination of lead and suspected asbestos-containing fire bricks across the surface of the site.
- Historical activities associated with Schnitzer Steel Products automobile salvage yard. Specific sources include an undefined battery storage location, automobile crusher, automobile shredder, and a general dissemination of petroleum hydrocarbons and lead across the surface of the site.
- Historical releases in the vicinity of the Drum Storage Area. These include those that have had removal actions undertaken and the possibility of other releases that may have occurred in the area, prior to Gunderson's control.

8.2. Overwater Activities

☒ Yes ☐ No

The application of marine primers and paints onto the marine barges is conducted on the launchways. This work is considered over-water activity. Completed railcars are temporarily staged on outfitting dock (gantry) for re-work of welds, touch-up painting, and using a transit to make sure cars are level.

8.3. Spills

In 1980, an Area 1 tank holding approximately 200 gallons of TCA spilled onto asphalt and concrete as noted in Section 8.1. No known or documented spills at the Gunderson Facility are listed in either DEQ SPINS database for the period of 1995 to 2003, from oil and chemical spills recorded from 1982 to 1989 by the U.S. Coast Guard and the National Response Center's centralized federal database [see Appendix E of the Portland Harbor Work Plan (Integral et al. 2004)], or from DEQ correspondence.

9. PHYSICAL SITE SETTING

9.1. Geology

Cross-sections of the subsurface below the Gunderson facility are presented in Figures 7 through 16. Information on the subsurface of the Gunderson facility is based on the following:

- 36 borings,
- 65 monitoring wells,
- 93 direct push probes, and
- 9 test pits.

Alluvium and Younger Terrace Deposits : The Gunderson facility is underlain by recent alluvial deposits of the Willamette River. Aerial photographs and other historic records indicate that the part of the Gunderson site adjacent to the Willamette River was raised above the river level beginning in the 1930s using dredged fill material. The man-made fills were placed over much of the site. Therefore, most of the sand and silt found in the subsurface of the Gunderson site are fill material obtained from the dredging of the Willamette River channel. Occasionally, concrete or gravel fill is encountered at surface, or just below the asphalt.

The site explorations have disclosed that these alluvial deposits consist mainly of sand and silt. All of the borings, monitoring wells, direct push probes and test pits placed on site encountered shallow sand and silts. The native alluvium and younger terrace deposits generally consist of unconsolidated sand, silt, clay, and gravel deposited in the channels and on the flood plains of the Willamette River and its tributaries. This unit is typically 30 to 40 feet thick in Area 1 and based on deep geotechnical borings completed by Squier Associates and others, this unit has an apparent maximum thickness of approximately 160 feet in Area 2.

<u>Gravel Zone</u>: Gravels, are encountered at the base of the recent alluvial deposits in some but not all of the borings. In the northwestern portion of Gunderson's Area 1, the gravels are typically encountered at about depth 35 feet. These gravels appear to be geologically recent alluvial deposits and not an older distinct geological unit, such as the Troutdale Formation. Borings placed in the Willamette River suggest that the onshore sand and sandy silt and the offshore clayey silt (Willamette River sediments) are both underlain by a rounded gravel that contained sand, cobbles, and boulders.

The generic term "gravel" is a size classification term used to describe the material that predominantly consists of angular to subangular clasts of basalt that are between 0.2 inches and 3 inches in diameter. In the northwestern portion of Gunderson's Area 1, the Gravel Zone includes some cobbles (3 inches to 10 inches) and occasional boulders (greater than 10 inches) of basalt. Weathering of the basalt clasts ranges from slight to severe. Clasts of quartzite, which are characteristic of the Troutdale Formation, were observed in the gravels, however these quartzite clasts are very well rounded and probably represent reworked clasts of eroded and transported Troutdale Formation and are not indicative of the presence of the Troutdale Formation. The presence of these well rounded quartzite clasts along the northern property boundary suggest that a well graded gravel channel exists in this area.

The upper portion of the Gravel Zone tends to have a matrix consisting of fine to coarse sand. This would be consistent with a depositional environment from the erosion of the Tualatin Mountains. The gravels encountered directly above the basaltic bedrock generally had a matrix of fractured basalt and clay. This lower portion of the Gravel Zone appears to possibly be residual basalt, developed in place, and not transported as a gravel. The presence of a residual basalt, or highly weathered upper section of basalt, would imply a gradational interface from the shallow sediments to the basalt. As expected, the greatest amount of weathering was found in the vicinity of the areas where no detrital gravels were encountered and the borings went directly from the shallow sediments to competent basalt.

Gravels were encountered at depths between 70 feet and 110 feet in Area 2. However, there were also borings that extended to 130 feet and did not encounter gravel. The gravels encountered in Area 2 were typically basaltic in origin and angular, suggesting a lack of transport distance.

<u>Basalt</u>: Directly beneath the shallow sediments and gravels (if encountered) is a basalt unit. An important geologic feature that exists in the northeastern portion (adjacent to the river) of the Gunderson facility is a basalt block encountered at about depth 30 feet. The gravels are not typically encountered when the basalt is encountered at about depth 30 feet. A gravel zone mantles the western face of the basalt block and forms a channel that traverses the site in a north/south direction. This feature is likely caused either by a structural fault in the bedrock that has resulted in an uplifted basalt block near the Willamette River or by a gravel-filled paleochannel. A petrographic study of basalt core retrieved from one borehole indicates that the

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basalt is consistent with the top of Portland's Columbia River Basalt Group (CRBG) profile. Specifically, the uppermost basalt belonged to the Sand Hollow Unit of the Frenchman Springs Member of the Wanapum Basalt Formation.

An interflow zone was observed in at least one boring. The basalt obtained from below this interflow zone represents Sentinel Bluffs basalt. The interflow zone, corresponding to the Vantage Horizon has been identified at about depth 92 feet near the Willamette River and about depth 73 feet in a boring placed about 650 feet west. The Vantage Horizon is a paleosol that represents a hiatus between fissure eruptions of the CRBG. Accordingly, it is laterally extensive and provides a marker bed for correlating units.

The basalt has been found to slope uniformly east into the Willamette River at about 0.03 feet per foot and then steepen to about 0.1 feet per foot as the CRBG went below the Willamette River. The depth to basalt also increases southward. It has not been determined if this is due to steeply dipping basalt flows or fault blocks. This determination is based on investigations wherein basalt was encountered in Area 2 at depths around 150 to 160 feet.

9.2. Hydrogeology

Ground water migration below the Gunderson facility, especially Area 1, is complex due to the heterogeneities of the subsurface (refer, Figures 7 through 16). The subsurface consists of three primary hydrogeologic units. The hydrogeologic units, beginning with the shallowest, are as follows:

1. Shallow Sand/Silt Unit,
2. Gravel and Gravel-like Rock Unit (includes fractured rock), and
3. Basalt Bedrock.

The shallow sand/silt unit is considered a portion of the Unconsolidated Sedimentary Aquifer of the Portland Basin. The subsurface material in this unit consists of zones of transitional sands, sandy silt, silts, and some clay. These zones are discontinuous lenses, interfingered across the site. This arrangement is typical of river deposits and man-made fill deposits from dredge spoils. Dredge spoils would have been derived from the Willamette River. For our model, we have been able to categorize these into a surficial sand and fill zone, a predominantly silt zone, and an underlying predominantly sand zone. Included in the sand and fill zone are fill deposits containing concrete and other debris.

The Gravel and Gravel-like Rock Unit is between the overlying shallow sand/silt unit and underlying bedrock. This unit is not present everywhere below the Gunderson facility. The first encountered gravels of this unit exhibit the typical characteristics of detrital gravel, such as rounding and grain-size gradations, as well as the presence of non-basalt rocks. They are considered a portion of the Unconsolidated Sedimentary Aquifer. However, some of the rock fragments found directly above the basaltic bedrock appear to be related to in-place weathering of the basalt (angular, weathered basalt gravel zone) and not transported as a sedimentary deposit. This angular, weathered basalt gravel consists of angular rock fragments that exhibit moderate to severe weathering, as evidenced by the amount of clay alteration. These weathered basalt rock fragments have similar hydrogeological characteristics as the sedimentary deposited (detrital) gravels, compared to the basalt bedrock. Based on this similarity in hydrogeological characteristics, the fragmented zone of the basalt bedrock will be categorized as part of the Unconsolidated Sedimentary Aquifer.

Basalt bedrock consists of flows of the CRBG, which is considered part of the Older Rocks Subsystem by the US Geological Survey. The CRBG is estimated to be about 500 to 700 feet thick in this area and consists of at least six discrete lava units. The hydrogeological characteristics of the CRBG vary significantly, depending upon the structural nature of the flow and degrees of weathering. The best water producing zones of the CRBG coincide with interflow zones. The interflow zones tend to be very fractured and contain highly permeable vesicles.

Rocks formed from ancient marine sediments exist below the CRBG at a depth of probably between 500 feet and 700 feet. This sedimentary rock unit was not encountered in explorations at the Gunderson facility. The ancient marine sedimentary rocks are considered poor aquifers in this area and are not considered in the Conceptual Hydrogeologic Model.

The review of the subsurface data also indicates the presence of a north/south trending structure that parallels the Portland Hills Fault. The structure is typified by an apparent sharp topographic break in the basalt surface. Subsurface materials consistent with the Gravel and Gravel-like Rock Zone are not present on the high bedrock block, encountered at about depth 30 feet. A channelized gravel feature (consisting of the detrital gravel zone and gravelly fractured basalt zone) has been identified overlying the basalt in the western portion of the site, to the west of the structure. The Gravel and Gravel-like Rock Zone represents a more conductive flow regime than the overlying sediments or the underlying bedrock, consequently, the Gravel and Gravel-like Rock Zone provides a layer with greater water transmitting capability on top of the basalt bedrock. A zone of even more permeable gravel, suggested by the roundness of the individual clasts, exists along the northern boundary between the Gunderson and Lakeside Industries sites. Well-rounded detrital gravels typically have a greater hydraulic conductivity than angular, clay-infilled gravels, such as those located in the area of the TCA release.

The conductive character of the various water-bearing zones have been evaluated using a variety of techniques including aquifer performance tests, slug tests, and packer tests, as well as literature reviews. Based on our evaluations the following hydraulic conductivity values are believed to be typical of each of the units:

- sand/silt unit 1 foot per day
- detrital gravel zone 100 feet per day
- gravelly fractured basalt zone 50 feet per day
- fractured basalt zone 10 feet per day
- massive basalt zone 0.1 feet per day
- Vantage Horizon 5 feet per day

The low hydraulic conductivity value for the Vantage Horizon is believed to represent the limited water availability in that zone. The Vantage Horizon is positioned between two massive, relatively impermeable basalt formations.

The ground water flow directions and gradients below the Gunderson facility have been periodically monitored since 1991. Based on this data, it appears that the shallow groundwater flow direction is generally north towards the Willamette River. The flow direction of groundwater in the gravels appears to be generally northeastward, towards the Willamette River.

Figure 5 graphically presents the variation of site groundwater levels in relation to time. The average water levels for various site areas (including perched and deep groundwater zones) are presented to illustrate the differences in groundwater response and elevation. The elevation of the Willamette River is presented to show the response of site water levels to fluctuations in river stage. The shallow and deep groundwater zones of Area 1 are graphed separately on Figure 5. The figure indicates very slight differences in water elevations between the shallow and deep zones of the Area.

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The horizontal groundwater gradient (0.025 feet per foot) in the southeastern portion of the facility is steeper than the gradient in the northwestern portion (0.003 feet per foot). Currently there are eight pairs of monitoring wells with a shallow well and a deeper well completed in close proximity to each other. The vertical gradient was calculated as the difference in water level elevation over the difference in vertical distance of the midpoints of the well screen intervals. As part of this study the following vertical gradients in feet per foot (ft/ft) were calculated for the March 30, 2004 groundwater elevation measurements:

Monitoring Well Pair	Vertical Gradient
MW-20 / MW-39	0.010 ft/ft
MW-45 / MW-36	0.001 ft/ft
MW-37 / MW-52	-0.003 ft/ft
MW-49 / MW-38	-0.003 ft/ft
MW-52 / MW-53	-0.045 ft/ft
MW-37 / MW-53	-0.048 ft/ft
MW-50 / MW-43	-0.115 ft/ft
MW-41 / FM48-15	No Data Available

Analysis of the calculated vertical gradient information indicates a relatively neutral component of vertical groundwater movement. Positive vertical gradient values indicate an upward component of groundwater movement. A negative vertical gradient value indicates a downward component of groundwater movement. The results of the analysis indicate a downward vertical gradient in the general vicinity of MW-50 and MW-43 at approximately -0.115 ft/ft. This pair is located closest to the Willamette River. The vertical gradients associated with the remainder of the monitoring well pairs appear to be relatively neutral because the magnitude of the variation in vertical gradients is within a margin of error associated with the accuracy of the water level meter.

10. NATURE AND EXTENT *(Current Understanding)*

10.1. Soil

10.1.1. Upland Soil Investigations

☒ Yes ☐ No

The first soil investigation in Area 1 was conducted pursuant to conclusions and recommendations presented in a Level I Environmental Site Assessment completed in 1990. HVOCs were not detected in the soil samples collected during these studies. A subsurface investigation in the vicinity of the TCA dip tank was performed in March 1995 to evaluate the known areas that received the TCA release. The subsurface investigation initiated in the vicinity of the TCA dip tank included two Geoprobes and one test pit. The subsurface investigation also included the placement of one test pit along the reported pathway of the TCA spill. The chemical analyses of the soil samples detected the presence of TCA in an upgradient probe location, a downgradient probe location, and the test pit. The greatest concentration of TCA detected in soil was 30 mg/Kg.

10.1.2. Rivebank Samples ☒ Yes ☐ No

One river bank and four near shore, sandy beach samples were collected during the work documented in the Area 2 XPA (January 2004). Arsenic and butyl tins were found on the sandy beach located at the downstream extent of Area 2, specifically an area formerly occupied by launchways and downstream of BES Willamette Outfall #18. Both arsenic and butyl tins could have been used for antifouling treatment and control biological growth on wood structures that were subjected to being immersed in the river, but could also be deposited from upriver sources. The presence of monobutyl tin as the dominant form suggested that the compound has been weathered.

Samples were also collected on the sandy beach located further upstream in Area 2, where the BES Willamette Outfall #18 discharges to the Willamette River, which is also downstream of and adjoining the Marine Blast Area. In addition, the embayment that creates this beach is formed by the presence of the Equilon Dock, which is used for the transfer of petroleum products to and from the inland Shell Bulk Facility. The sands nearest the outfall typically produced greater concentrations of COPCs when compared to the other sandy beach area samples. The COPCs identified for this sandy beach include heavy oil, PCBs, metals, high molecular weight PAHs, and butyl tins.

Additional samples have been collected along the Marine Barge Launchways. The results of the Marine Barge Launchways sampling and analysis event have not been published as of August 2004.

Seven river bank samples have also been collected as part of the RI for Area 3. The results of the Area 3 RI have also not been published as of August 2004. The river bank in Area 3, at the location of Seep-01 was sampled in 1998 and found to contain elevated levels of lead, cadmium, chromium, copper, mercury, zinc, oil, and PCBs.

10.1.3. Summary

The area identified as the Former Access Gully in Area 3, the extreme upstream portion of the Gunderson facility, has been found to consist of fill material contaminated with lead, PCBs, petroleum hydrocarbons, and chromium. Groundwater seeping from the base of the filled gulley (Seep-01) has been found to be contaminated with similar COPCs.

Another river bank area found to produce soil contamination is located at the City of Portland's Outfall #18. This area is also adjacent to the Marine Barge Paint Blast Building. Neither location has been identified as the source of the contamination.

10.2. Groundwater

10.2.1. Groundwater Investigations ☒ Yes ☐ No

The first ground water investigation in Area 1 was conducted along with the soil explorations completed pursuant to conclusions and recommendations presented in a *Level I Environmental Site Assessment (ESA)* completed in 1990. The ground water investigations conducted as part of the *Level II ESA* and the subsequent *Soil and Ground Water Investigation* encountered two halogenated volatile organic compounds (HVOCs), TCA and tetrachloroethene (perchloroethene or PCE), in the ground water in this area, along with several of their possible chemical breakdown products. However, HVOCs were not detected in the soil samples collected during these studies.

A subsurface investigation in the vicinity of the TCA dip tank was performed in March

1995 to evaluate the known areas that received the TCA release. The subsurface investigation initiated in the vicinity of the TCA dip tank included two Geoprobes and one test pit. One sampling point was placed in a location suitable to sample ground water slightly upgradient of the TCA dip tank, and another sampling point was placed downgradient of the TCA dip tank, at the reported termination point of the TCA spill. A concentration of 170 milligrams per liter (mg/L) of TCA was detected in the water sample collected from upgradient sample point. The concentration of TCA detected in the water sample collected from the sample point located downgradient of the TCA dip tank and at the terminus of the spill, was 0.79 mg/L.

Subsequent investigations further evaluated and documented the release of TCA into the subsurface. Additional monitoring wells were constructed so that the presence of TCA, and related HVOCs in the ground water could be evaluated through periodic monitoring. The monitoring well network currently includes wells completed in each of the soil and rock-unit horizons below the site: shallow sand and silt, gravel, and basalt. Specifically, the following numbers of monitoring wells have been constructed for each unit and position:

- Shallow Sand / Silt Unit Upgradient Monitoring Wells: 3
- Shallow Sand / Silt Unit Monitoring Wells at Source: 1
- Shallow Sand /Silt Unit Downgradient Monitoring Wells: 3
- Gravel Unit Upgradient Monitoring Wells: 2
- Gravel Unit Monitoring Wells at Source: 1
- Gravel Unit Downgradient Monitoring Wells: 7
- Basalt Unit Downgradient Monitoring Wells 3

The hydrogeological relationship between the basalt and overlying sand, silt, and gravel units was further investigated in order to evaluate if the hydrogeological characteristics of the basalt would allow ground water to migrate from gravel zones and disperse into the Willamette River. This was accomplished using diamond coring techniques to map fractured zones and a pneumatic packer system to isolate a zone for purging and sampling. The placement of monitoring well MW-52 at about depth 49 feet in a weathered-basalt zone and monitoring well MW-53 at about depth 101 feet, in the Vantage Horizon and below, were due to the results of the pneumatic packer system-assisted study.

10.2.2. NAPL (Historic & Current) ☐ Yes ☒ No

The investigations in the TCA source area have not encountered a DNAPL.

10.2.3. Dissolved Contaminant Plumes ☒ Yes ☐ No

Plume Characterization Status ☒ Complete ☐ Incomplete

The ground water conditions and plume chemistry have been periodically monitored since 1991. The primary contaminant (greater than 60 % of measured contaminant concentration) of the HVOC plume is dissolved TCA. The degradation compound 1,1-dichloroethene (1,1-DCE) is also a contaminant of concern. The monitoring has allowed the development of an approximate delineation of the plume margins. Figure 17 presents our interpretation of the shallow HVOC plume geometry and Figure 18 presents our interpretation of the deeper HVOC plume geometry.

Concentration trends within the plume for shallow and deep groundwater have been periodically evaluated using constituent concentration versus time line graphs for selected monitoring wells. The concentration trend evaluations indicate a generally declining trend for contaminant concentrations in the near source shallow groundwater. In addition, the trend evaluation indicates a generally increasing trend for contaminant concentrations of the deep groundwater far from the source area.

Table 1 presents our evaluation of the contaminant plume composition. Our review of the plume composition supports our opinion that the HVOC concentrations are generally similar to concentrations evaluated during previous quarters of groundwater monitoring.

Plume Extent

The lateral extent of the dissolved TCA plume is presented in Figures 17 and 18.

Min/Max Detections (Current situation)

A summary of the minimum and maximum detections in groundwater at the site is provided in the table below. The following minimum and maximum detections presented below were developed from the most recent data collected at each sampling point over the site.

Analyte	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Chloroform	ND	0.00116
1,1-Dichloroethane	ND	0.345
1,2-Dichloroethane	ND	0.26
1,1-Dichloroethene	ND	0.561
Tetrachloroethene	ND	0.0167
1,1,1-Trichloroethane	ND	3.88
Trichloroethene	ND	0.00106
Cis-1,2-dichloroethene	ND	0.00491
Total HVOC	ND	4.827

Current Plume Data

The current estimated extent of groundwater impacted by COIs is shown in Figure 3.

Preferential Pathways

A north/south trending subsurface structure that parallels the Portland Hills Fault has been identified. The structure is typified by an apparent sharp topographic break in the basalt surface. Subsurface materials consistent with the Gravel and Gravel-like Rock Zone are not present on the high bedrock block, encountered at about depth 30 feet. A channelized gravel feature (consisting of the detrital gravel zone and gravelly fractured basalt zone) has been identified overlying the basalt in the western portion of the site, to the west of the structure (refer, Figures 11 and 12). This channel appears to be a primary, favorable pathway for the migration of the TCA-contaminated ground water.

Downgradient Plum Monitoring Points (min/max detections)

Table 1 presents the characterization of the TCA plume, based on the available analytical data.

Visual Seep Sample Data ☒ Yes ☐ No

One seep has been identified in Area 3, although it was not identified in the LWG seep survey conducted in 2003. This seep (Seep-01) has been attributed to the apex of a former gulley that allowed access to the river from the upland area during the ship dismantling activities of the 1960's. The gulley was apparently filled in the 1970's and the contact between the recent fill and the original hydraulic fill is a transmissive pathway. The seeping water has been sampled and found to contain evidence of petroleum hydrocarbons, PCBs, lead, chromium, and chlorobenzene.

Nearshore Pore Water Data

Two porewater samples were collected from one location directly offshore from the Marine Barge Launchways during the Weston *Portland Harbor Sediment Investigation Report* (May 1998)completed for the EPA. The samples were collected as paired set of duplicates for quality assurance and quality control (QA/QC). The two samples were analyzed for metals and organotins. Gunderson is not aware of other porewater samples that might have been collected in the nearshore environment of it's facility.

Groundwater Plume Temporal Trend

The temporal trends of the dissolved TCA plume are presented in Figures 19 and 20.

10.2.4. Summary

Groundwater contaminated with dissolved TCA and other associated halogenated compounds is migrating towards the Willamette River. This plume is located in Area 1, at the extreme downstream end of the Gunderson facility. Since there are no seeps in this general area, discharge to the river presumably would occur below the mean low water line. A groundwater ETS is being activated that will limit the further migration towards the river. Information on the plume is provided in other sections of this report.

Contaminated groundwater also discharges from a riverbank seep on the upstream end of the facility (in Area 3). This seep has been attributed to a preferential pathway created after a former gulley was filled. The seeping water has been found to contain petroleum hydrocarbons, PCBs, lead, chromium, and chlorobenzene.

10.3. Surface Water

10.3.1. Surface Water Investigation ☐ Yes ☒ No

There are currently no ponds, lakes, streams, or other forms of natural surface water impoundments on the site.

10.3.2. General or Individual Stormwater Permit (Current or Past) ☒ Yes ☐ No

Permit Type	File Number	Start Date	Outfalls	Parameters/Frequency
1200Z	DEQ File No. 30386	October 23, 1997	3	Copper, lead, zinc, total suspended solids, oil and grease/semi-annual

Do other non-stormwater wastes discharge to the system? ☐ Yes ☒ No

No non-stormwater wastes discharge to the stormwater system.

10.3.3. Stormwater Data ☒ Yes ☐ No

Stormwater data is annually summarized and submitted to DEQ and BES. In addition to the standard 1200Z parameters, the stormwater has been evaluated for additional COPCs since November 2002. The data suggests that PCBs have the potential to be released in Area 3. In addition to the three metals routinely evaluated as part of Gunderson's permit, it was recommended that other native metals also be monitored. The other native metals recommended for monitoring include antimony, arsenic, cadmium, nickel, and zinc.

10.3.4. Catch Basin Solids Data ☒ Yes ☐ No

Between May 31, 2003 and June 21, 2003, the catch basins and oil / water separators in Areas 1, 2 and 3 were cleaned. During this activity, samples were collected from the removed solids and analyzed for an extended list of analytes. The results of the analyses indicate the presence of petroleum hydrocarbons, PCBs, PAHs, aromatic VOCs, chromium, copper, lead, nickel, and zinc. See 10.3.7.

10.3.5. Wastewater Permit ☐ Yes ☒ No

Non-hazardous wastewater from plasma tables and Proceco axle wash is discharged to the City of Portland's sanitary sewer system. The permits for these discharges are renewed on an annual basis. Other occasional discharges to the City's system occur on a batch by batch basis and are tracked with Batch Permits.

10.3.6. Wastewater Data ☐ Yes ☒ No

Discharges to the City's system are non-hazardous.

10.3.7. Summary

Historical data suggests that some contaminated soil has become entrained in stormwater runoff. The entrained soil is collected in the filters placed in all the catch basins and oil / water separators located on the facility. Catch basin cleaning activity has proven that the filters are removing the solids and associate entrained contaminants from the storm water effluent prior to discharge to the Willamette River. Accordingly, stormwater runoff from the Gunderson facility should not be considered a significant source of COPCs for the Willamette River.

10.4. Sediment

10.4.1. River Sediment Data ☒ Yes ☐ No

In October 1997, representatives from Roy F. Weston, Inc., under contract to the EPA, collected a set of sediment samples at 8 locations directly offshore from Gunderson's facility. The sampling activity was part of an assessment of the 5.5-mile section of the Willamette River, referred to as the Portland Harbor Sediment Study. The samples from the EPA/Weston study have all been identified with the prefix "SD". The six pertinent sample locations were designated SD-140, SD-142, SD-143, SD-144, SD-146, SD-147, SD-148, and SD-151. Sediment samples SD-140, SD-142, and SD-143 were located in the vicinity of the Equilon Dock. The sediment sample locations SD-144, SD-146, and SD-147 are located offshore of the Marine Barge Launchways. One sample each was collected from locations SD-140, SD-142, SD-144, SD-146, and SD-147. Two discrete samples were collected from location SD-143. Sediment sample location SD-151 was the last sample location for the Portland Harbor Sediment Study. Therefore, no upstream samples from sample location SD-151 were collected. Three discrete samples were collected for sediment sample location SD-151, which was located approximately 150 feet from the foot of the Former Access Gully. The sediment samples were chemically analyzed for a number of parameters, including the ones listed below:

- 44.00 mg/Kg, 32.80 mg/Kg, and 40.70 mg/Kg of chromium
- 80 mg/Kg, 14 mg/Kg, and 25 mg/Kg of lead
- 0.27 mg/Kg, 0.27 mg/Kg, and 0.11 mg/Kg of mercury
- 265 mg/Kg, 98 mg/Kg, and 141 mg/Kg of zinc
- 0.500 mg/Kg and 0.070 mg/Kg of Aroclor 1254
- 0.031 mg/Kg of Aroclor 1260.

Summary statistics for chemicals analyzed from the Weston study and others are provided in Table 2.

10.4.2. Summary

The 1997 Weston Portland Harbor Study (Weston 1998) conducted for the EPA identified two sediment sampling locations near Gunderson with relatively elevated levels of various COPCs. PCBs and lead were detected directly offshore from the Former Access Gulley. PCBs and lead are known contaminants in the river bank soil and seeping groundwater. Other sediment samples with elevated COPCs were found near the discharge point of the City of Portland's Willamette Outfall #18. Willamette Outfall #18 collects stormwater from a large section of industrial Portland, located west of the Gunderson facility. The sediment sampling location is also adjoining the Marine Barge Paint and Blast area, which produces blast grit.

11. CLEANUP HISTORY AND SOURCE CONTROL MEASURES

11.1. Soil Cleanup/Source Control

Limited soil removal / source control has been undertaken related to former USTs. This work has not been undertaken in the vicinity of the Willamette River. Additional source control / remedial efforts using vapor extraction techniques have also been employed in two locations away from the Willamette River.

Near river source control has been limited to the removal of blast grit from the Marine Barge area.

11.2. Groundwater Cleanup/Source Control

Groundwater treatment for dissolved halogenated compounds is being undertaken in Area 1. No other ground water cleanup activities have been warranted.

11.3. Other

The catch basins have been periodically cleaned on an annual basis. All drums of regulated hazardous waste are removed within 90 days of generation. Drums of hazardous waste are segregated and temporarily stored in a bermed storage area. No additional sources are known for the facility.

11.4. Potential for Recontamination from Upland Sources

See Final CSM Update.

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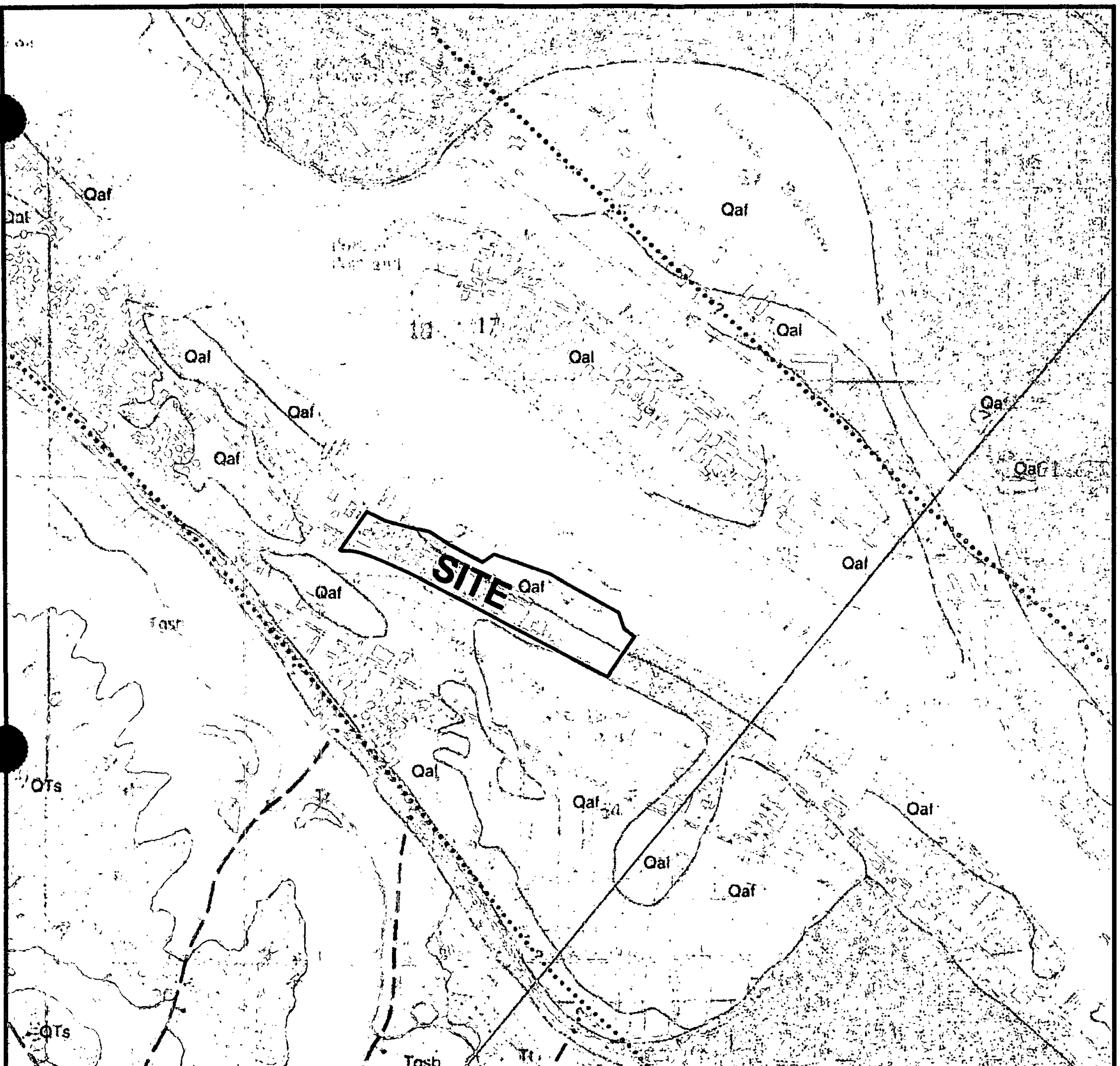
Figures:

Tables:

Supplemental Tables:

Table 1. Gunderson Site Outfall Nomenclature Key.
Table 2. Evaluation of Contaminant Plume Composition.

FIGURES



Source: Geologic Map of the Portland Quadrangle
Geologic Map Series: GMS - 75

GUNDERSON INC.
PORTLAND, OREGON

SITE LOCATION

FIGURE 1

SQUIER | KLEINFELDER
Employee-owned

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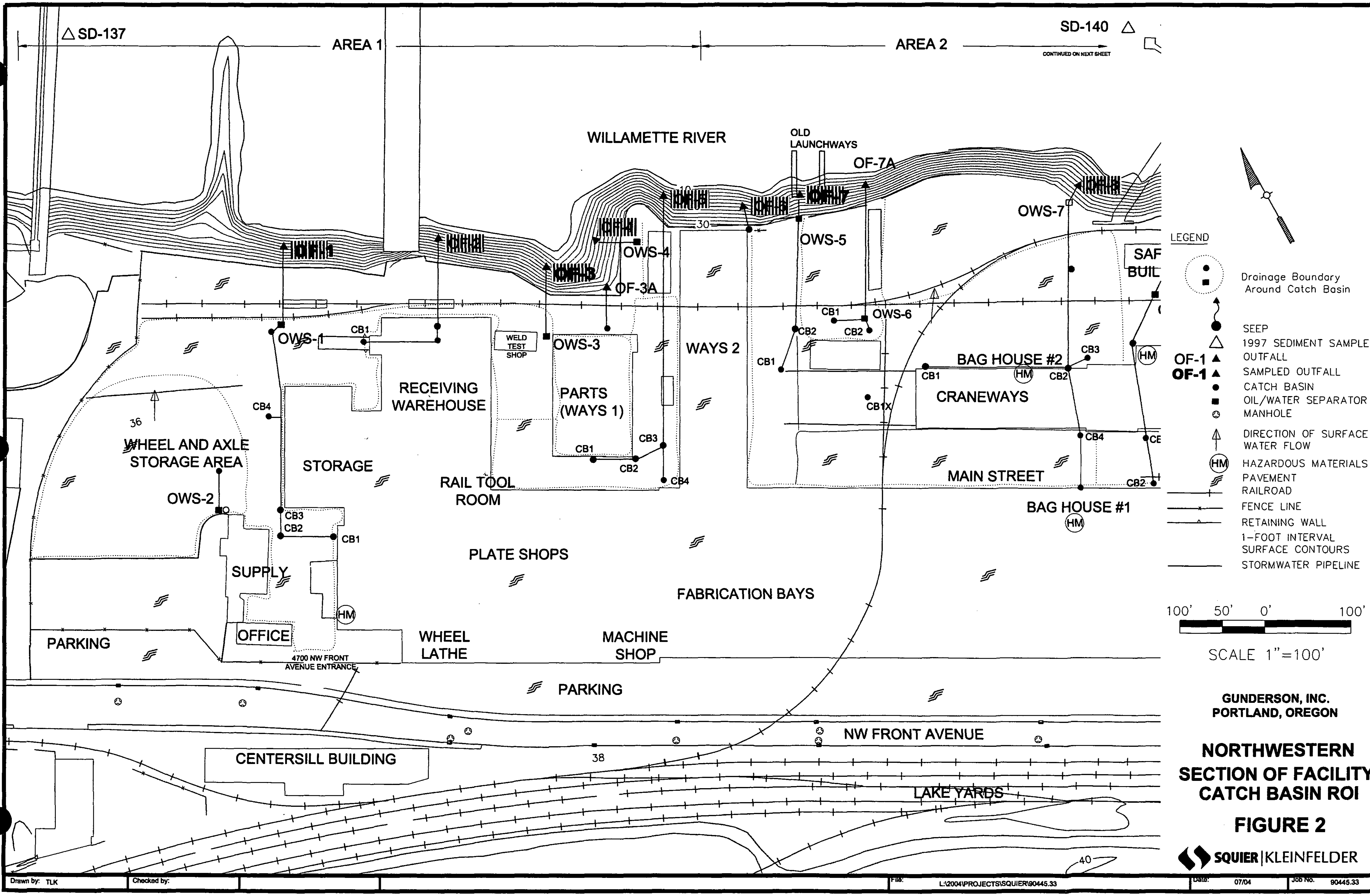

SD-137
AREA 1
AREA 2
SD-140
CONTINUED ON NEXT SHEET
WILLAMETTE RIVER
OLD LAUNCHWAYS
OF-7A
OWS-7
OWS-4
OF-3A
OWS-5
OWS-6
OWS-1
OWS-2
OWS-3
WELD TEST SHOP
RECEIVING WAREHOUSE
PARTS (WAYS 1)
WAYS 2
BAG HOUSE #2
CRANEWAYS
MAIN STREET
BAG HOUSE #1
WHEEL AND AXLE STORAGE AREA
STORAGE
RAIL TOOL ROOM
SUPPLY
PLATE SHOPS
FABRICATION BAYS
OFFICE
PARKING
WHEEL LATHE
MACHINE SHOP
4700 NW FRONT AVENUE ENTRANCE
NW FRONT AVENUE
CENTERSILL BUILDING
LAKE YARDS
LEGEND
Drainage Boundary Around Catch Basin
SEEP
1997 SEDIMENT SAMPLES
OF-1 OUTFALL
OF-1 SAMPLED OUTFALL
CATCH BASIN
OIL/WATER SEPARATOR
MANHOLE
DIRECTION OF SURFACE WATER FLOW
HM HAZARDOUS MATERIALS
PAVEMENT
RAILROAD
FENCE LINE
RETAINING WALL
1-FOOT INTERVAL SURFACE CONTOURS
STORMWATER PIPELINE
100' 50' 0' 100'
SCALE 1"=100'
GUNDERSON, INC.
PORTLAND, OREGON
NORTHWESTERN SECTION OF FACILITY CATCH BASIN ROI
FIGURE 2
SQUIER | KLEINFELDER
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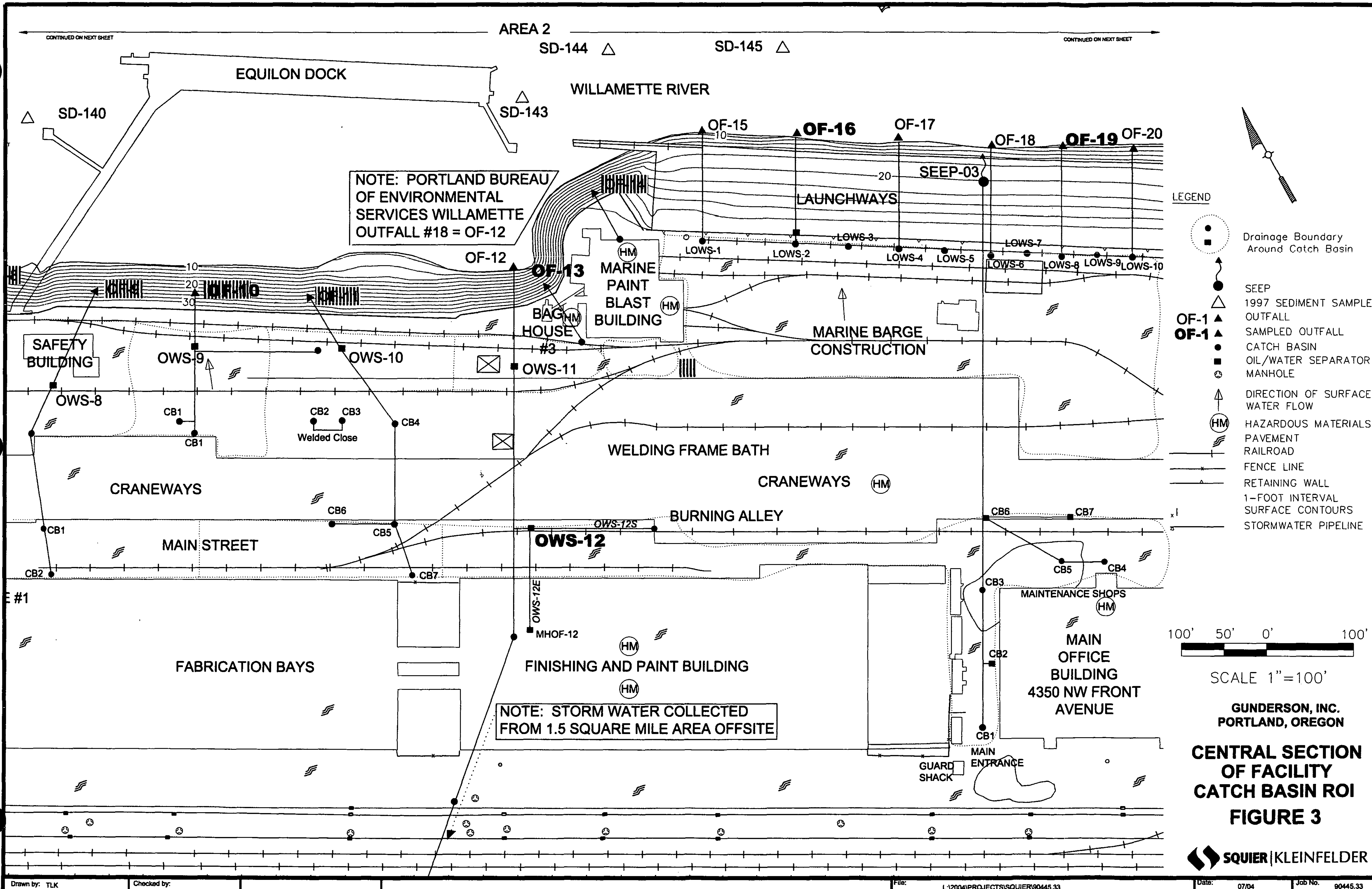

AREA 2
CONTINUED ON NEXT SHEET
CONTINUED ON NEXT SHEET
SD-144
SD-145
EQUILON DOCK
WILLAMETTE RIVER
SD-140
SD-143
NOTE: PORTLAND BUREAU OF ENVIRONMENTAL SERVICES WILLAMETTE OUTFALL #18 = OF-12
OF-15
OF-16
OF-17
OF-18
OF-19
OF-20
SEEP-03
LAUNCHWAYS
LOWS-1
LOWS-2
LOWS-3
LOWS-4
LOWS-5
LOWS-6
LOWS-7
LOWS-8
LOWS-9
LOWS-10
OF-12
OF-13
OF-10
MARINE PAINT BLAST BUILDING
BAG HOUSE #3
MARINE BARGE CONSTRUCTION
SAFETY BUILDING
OWS-8
OWS-9
OWS-10
OWS-11
CB1
CB2
CB3
CB4
Welded Close
WELDING FRAME BATH
CRANEWAYS
CRANEWAYS
BURNING ALLEY
MAIN STREET
CB6
CB5
CB7
CB1
CB2
OWS-12S
OWS-12
OWS-12E
MHOF-12
CB6
CB7
CB5
CB4
CB3
MAINTENANCE SHOPS
CB2
CB1
MAIN OFFICE BUILDING 4350 NW FRONT AVENUE
FABRICATION BAYS
FINISHING AND PAINT BUILDING
NOTE: STORM WATER COLLECTED FROM 1.5 SQUARE MILE AREA OFFSITE
GUARD SHACK
MAIN ENTRANCE
LEGEND
Drainage Boundary Around Catch Basin
SEEP
1997 SEDIMENT SAMPLES
OF-1 OUTFALL
OF-1 SAMPLED OUTFALL
CATCH BASIN
OIL/WATER SEPARATOR
MANHOLE
DIRECTION OF SURFACE WATER FLOW
HM HAZARDOUS MATERIALS
PAVEMENT
RAILROAD
FENCE LINE
RETAINING WALL
1-FOOT INTERVAL SURFACE CONTOURS
STORMWATER PIPELINE
100' 50' 0' 100'
SCALE 1"=100'
GUNDERSON, INC.
PORTLAND, OREGON
CENTRAL SECTION OF FACILITY CATCH BASIN ROI
FIGURE 3
SQUIER | KLEINFELDER
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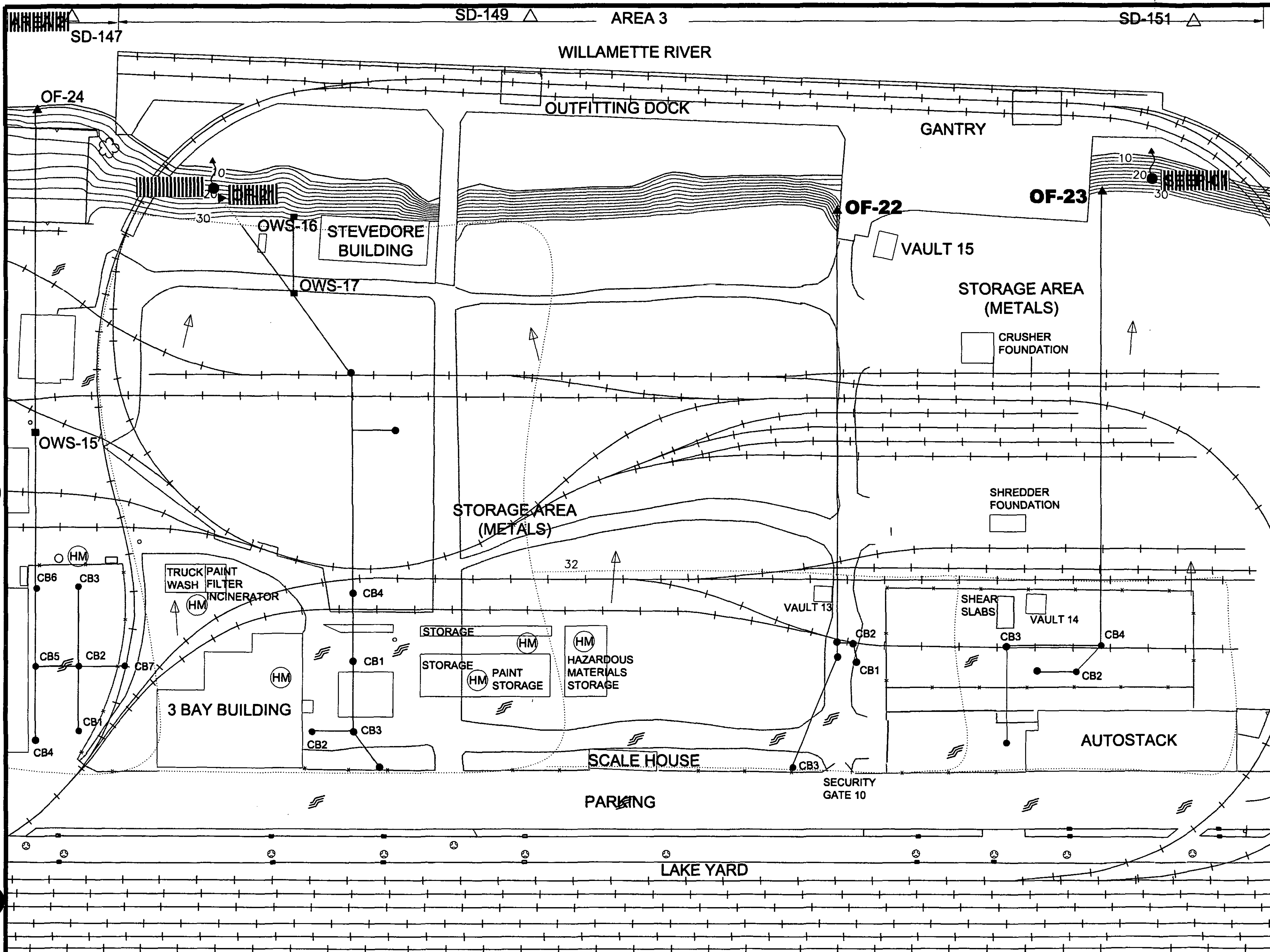

LEGEND

- Drainage Boundary Around Catch Basin
- SEEP
- 1997 SEDIMENT SAMPLES
- OF-1 OUTFALL
- **OF-1** SAMPLED OUTFALL
- CATCH BASIN
- OIL/WATER SEPARATOR
- MANHOLE
- DIRECTION OF SURFACE WATER FLOW
- HM HAZARDOUS MATERIALS
- PAVEMENT
- RAILROAD
- FENCE LINE
- RETAINING WALL
- 1-FOOT INTERVAL SURFACE CONTOURS
- STORMWATER PIPELINE

100' 50' 0' 100'

SCALE 1"=100'

GUNDERSON, INC.
PORTLAND, OREGON

SOUTHEASTERN SECTION OF FACILITY CATCH BASIN ROI

FIGURE 4

SQUIER | KLEINFELDER

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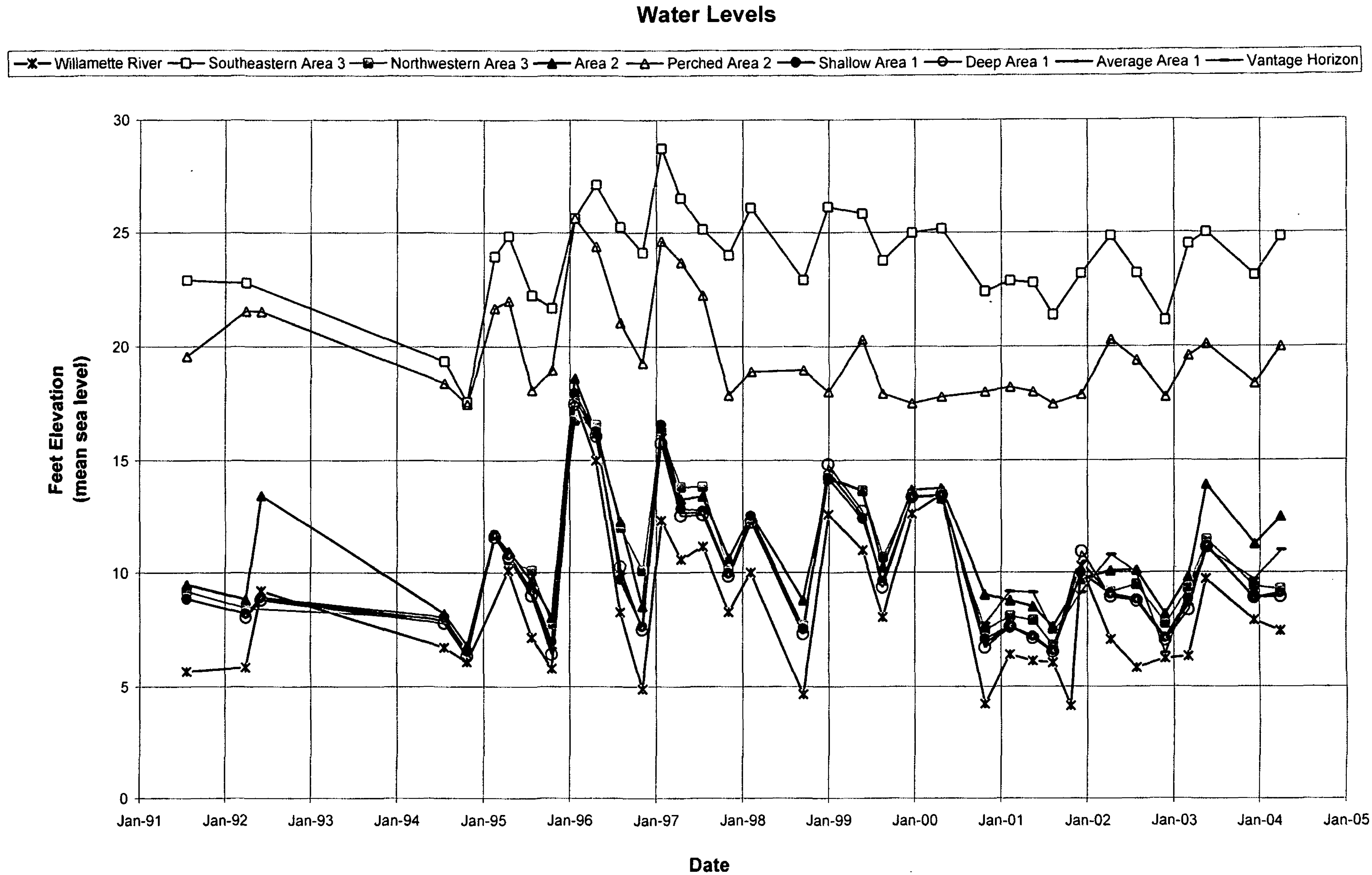

Gunderson, Inc

Squier | Kleinfelder

FIGURE 5

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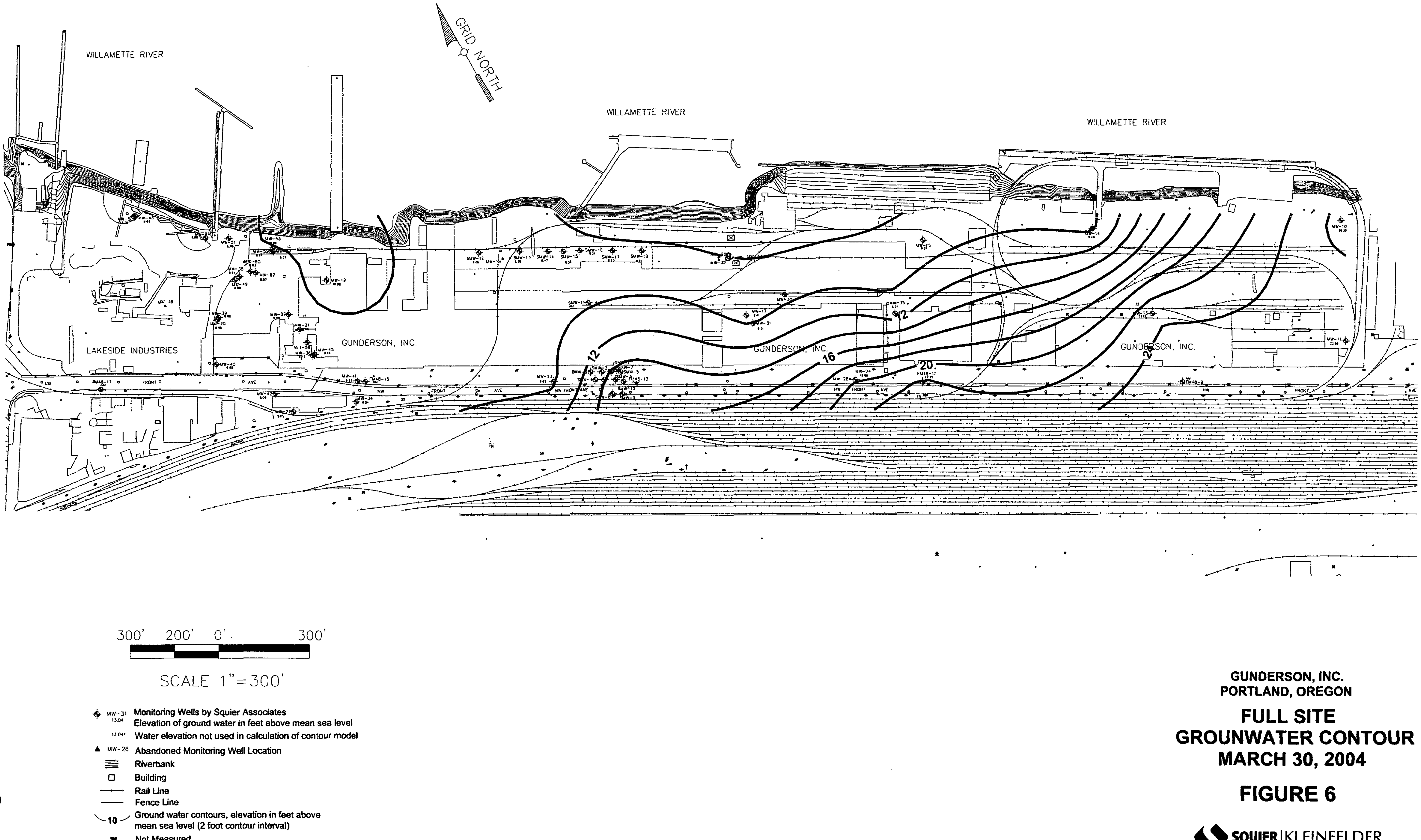

GUNDERSON, INC.
PORTLAND, OREGON

FULL SITE GROUNWATER CONTOUR MARCH 30, 2004

FIGURE 6

SQUIER | KLEINFELDER

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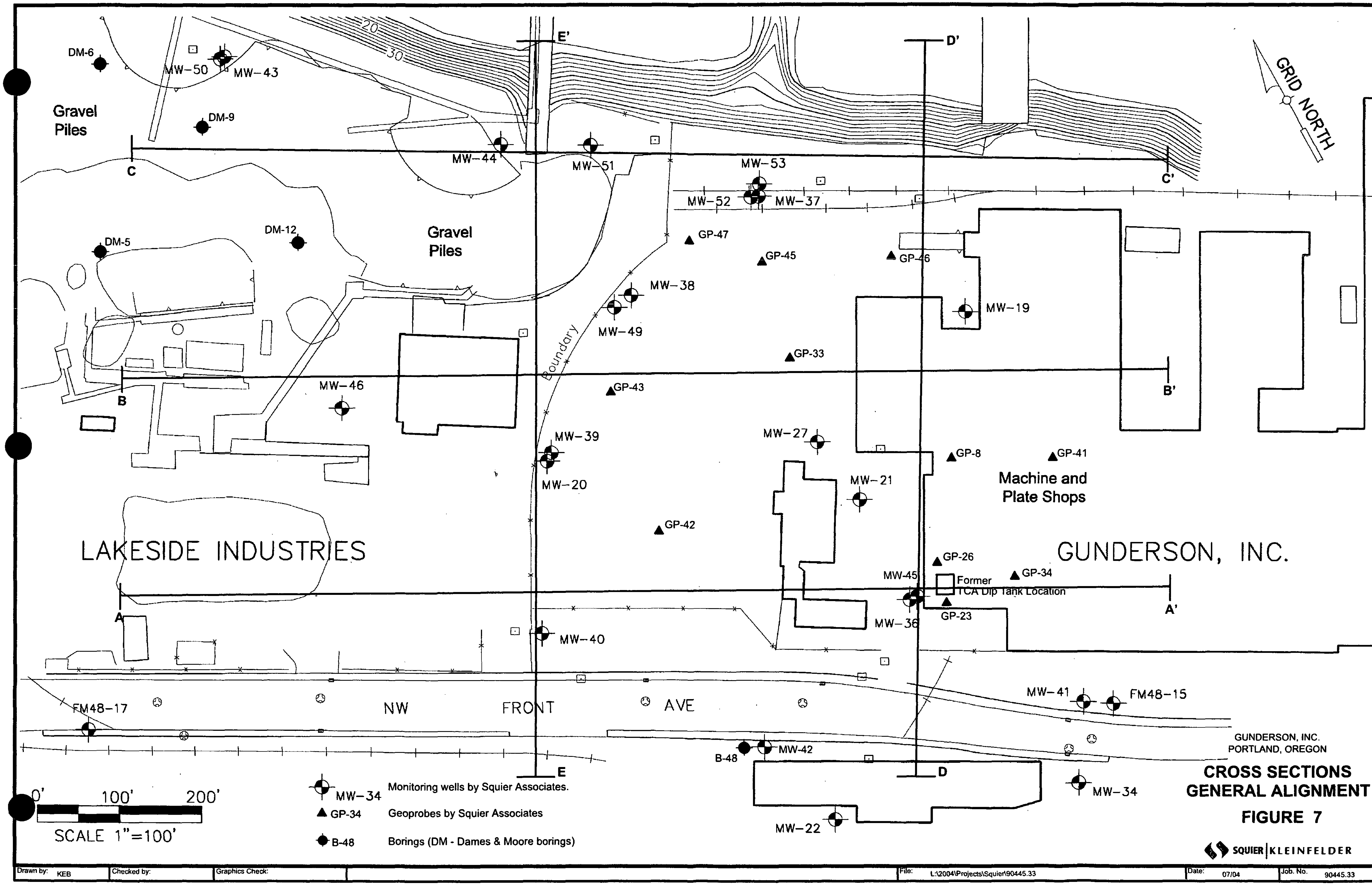
DM-6
MW-50
MW-43
Gravel Piles
DM-9
E'
D'
GRID NORTH
20
30
C
C'
MW-44
MW-51
MW-53
MW-52
MW-37
DM-12
DM-5
Gravel Piles
GP-47
GP-45
GP-46
MW-38
MW-49
MW-19
Boundary
GP-33
B
B'
MW-46
GP-43
MW-39
MW-20
MW-27
GP-8
GP-41
MW-21
Machine and Plate Shops
GP-42
LAKESIDE INDUSTRIES
GUNDERSON, INC.
GP-26
MW-45
Former TCA Dip Tank Location
GP-34
A
A'
MW-36
GP-23
MW-40
NW FRONT AVE
MW-41
FM48-15
FM48-17
B-48
MW-42
E
D
MW-34
MW-22
0' 100' 200'
SCALE 1"=100'
MW-34 Monitoring wells by Squier Associates.
GP-34 Geoprobes by Squier Associates
B-48 Borings (DM - Dames & Moore borings)
GUNDERSON, INC.
PORTLAND, OREGON
CROSS SECTIONS GENERAL ALIGNMENT
FIGURE 7
SQUIER | KLEINFELDER
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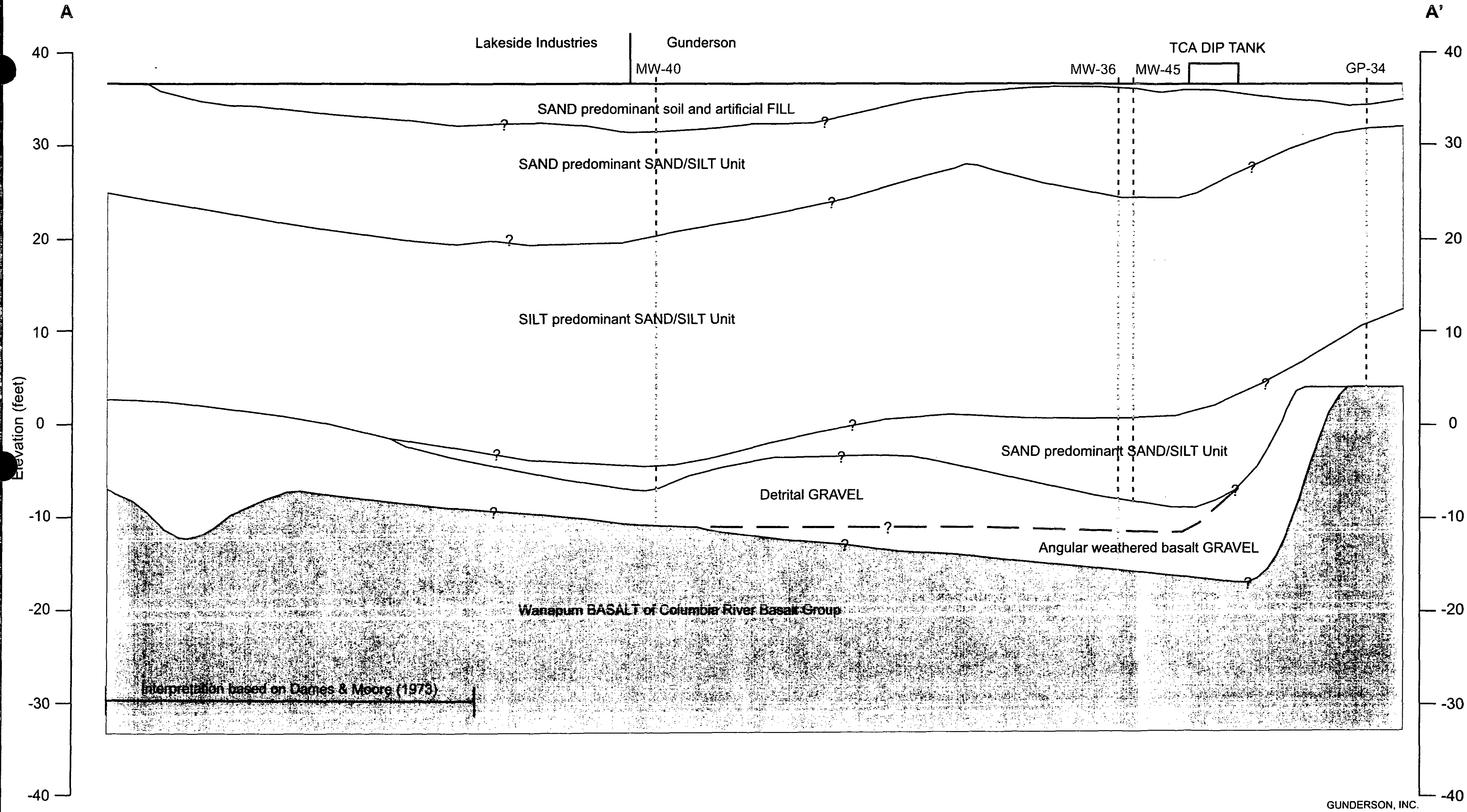

LEGEND

- FILL
- SAND
- BASALT
- SILT
- GRAVEL

This interpretive cross section is based on limited subsurface data and should not be used for construction purposes.

GUNDERSON, INC.
PORTLAND, OREGON

INTERPRETIVE CROSS SECTION A-A'
FIGURE 8

SQUIER | KLEINFELDER

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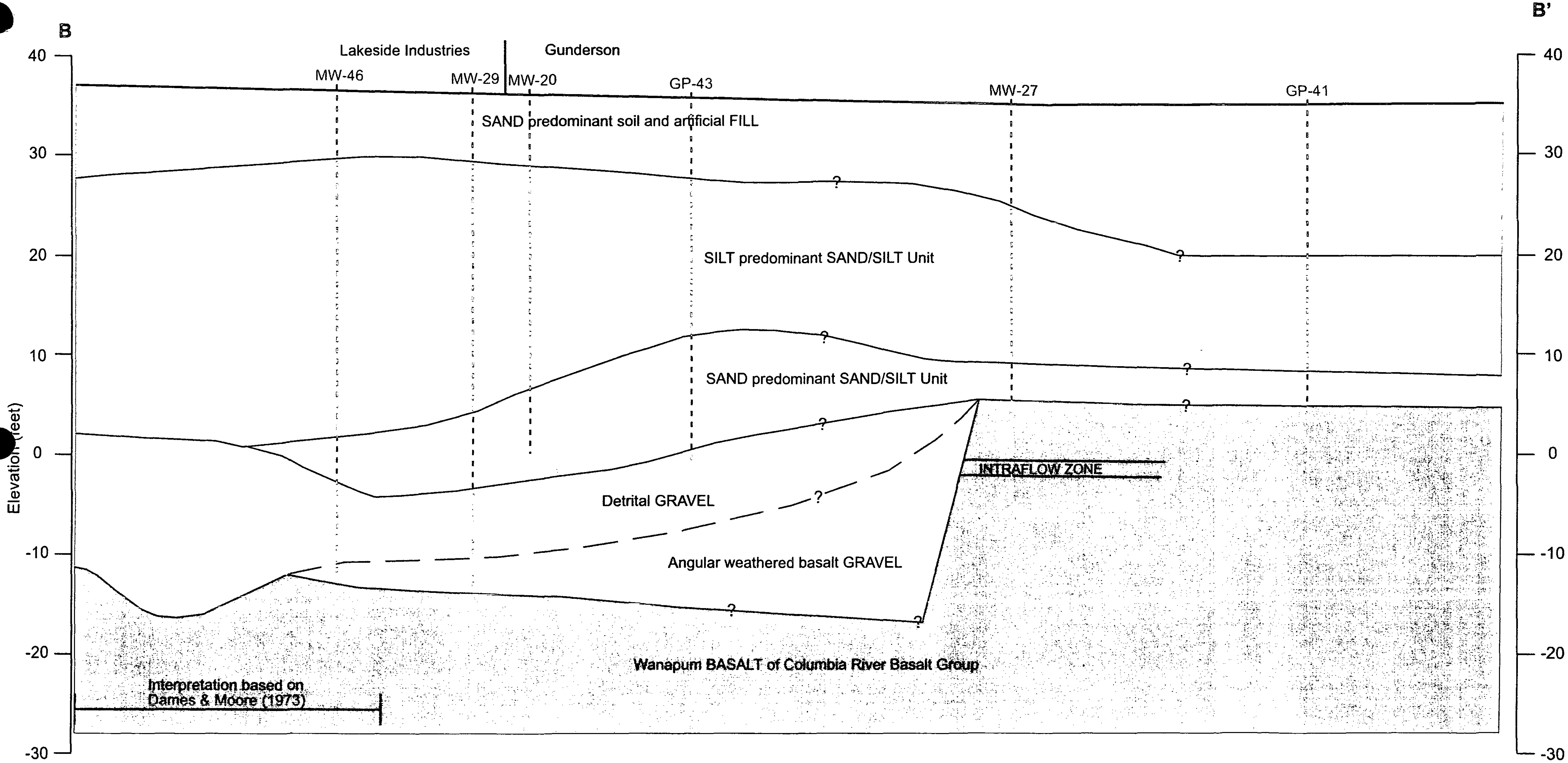

LEGEND

- FILL
- SAND
- BASALT
- SILT
- GRAVEL

This interpretive cross section is based on limited subsurface data and should not be used for construction purposes.

GUNDERSON, INC.
PORTLAND, OREGON

INTERPRETIVE CROSS SECTION B-B'
FIGURE 9

SQUIER | KLEINFELDER

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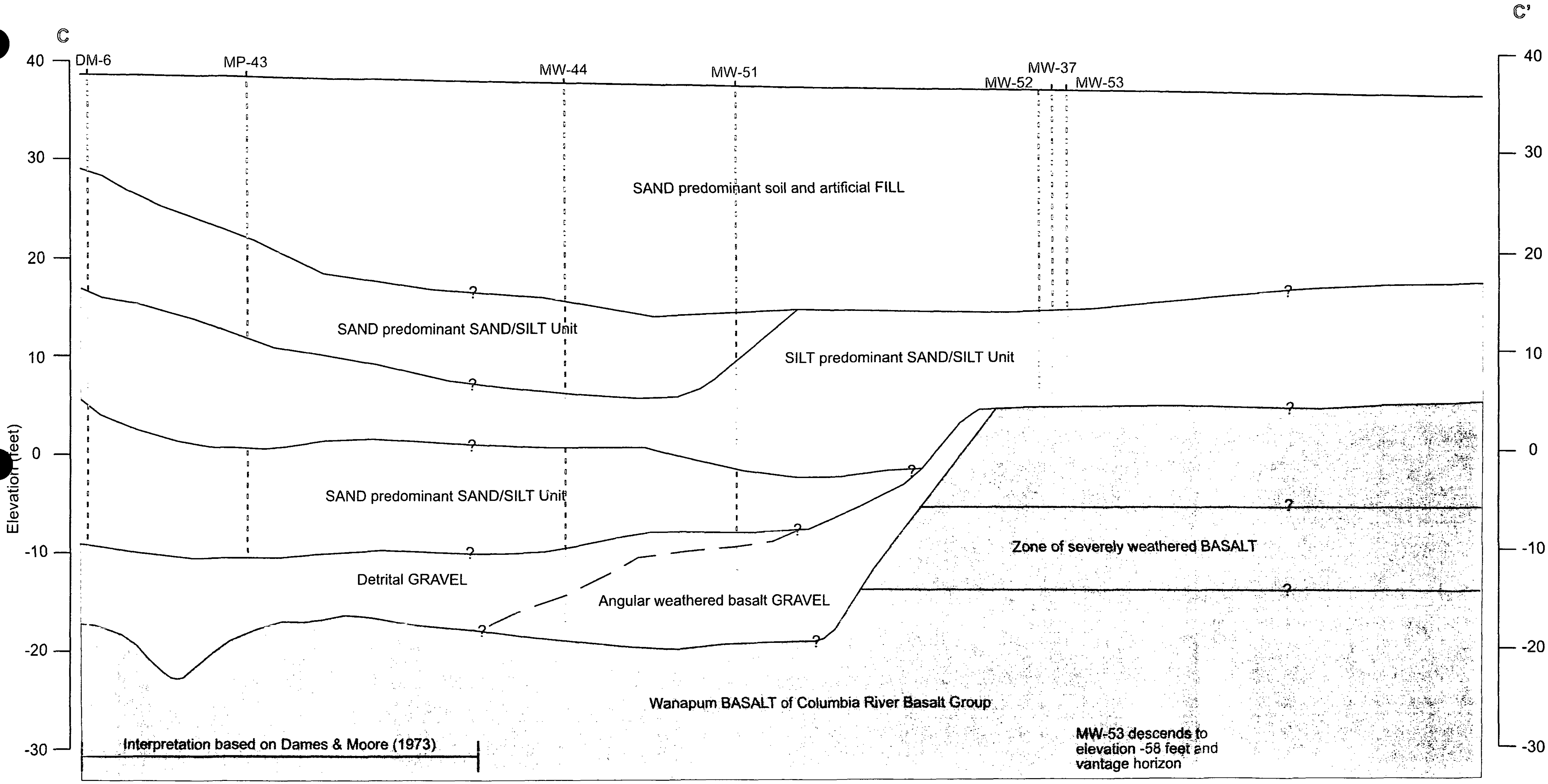

LEGEND

- FILL
-SAND
-BASALT
- SILT
- GRAVEL

This interpretive cross section is based on limited subsurface data and should not be used for construction purposes.

GUNDERSON, INC.
PORTLAND, OREGON

INTERPRETIVE CROSS SECTION C-C'

FIGURE 10

SQUIER | KLEINFELDER

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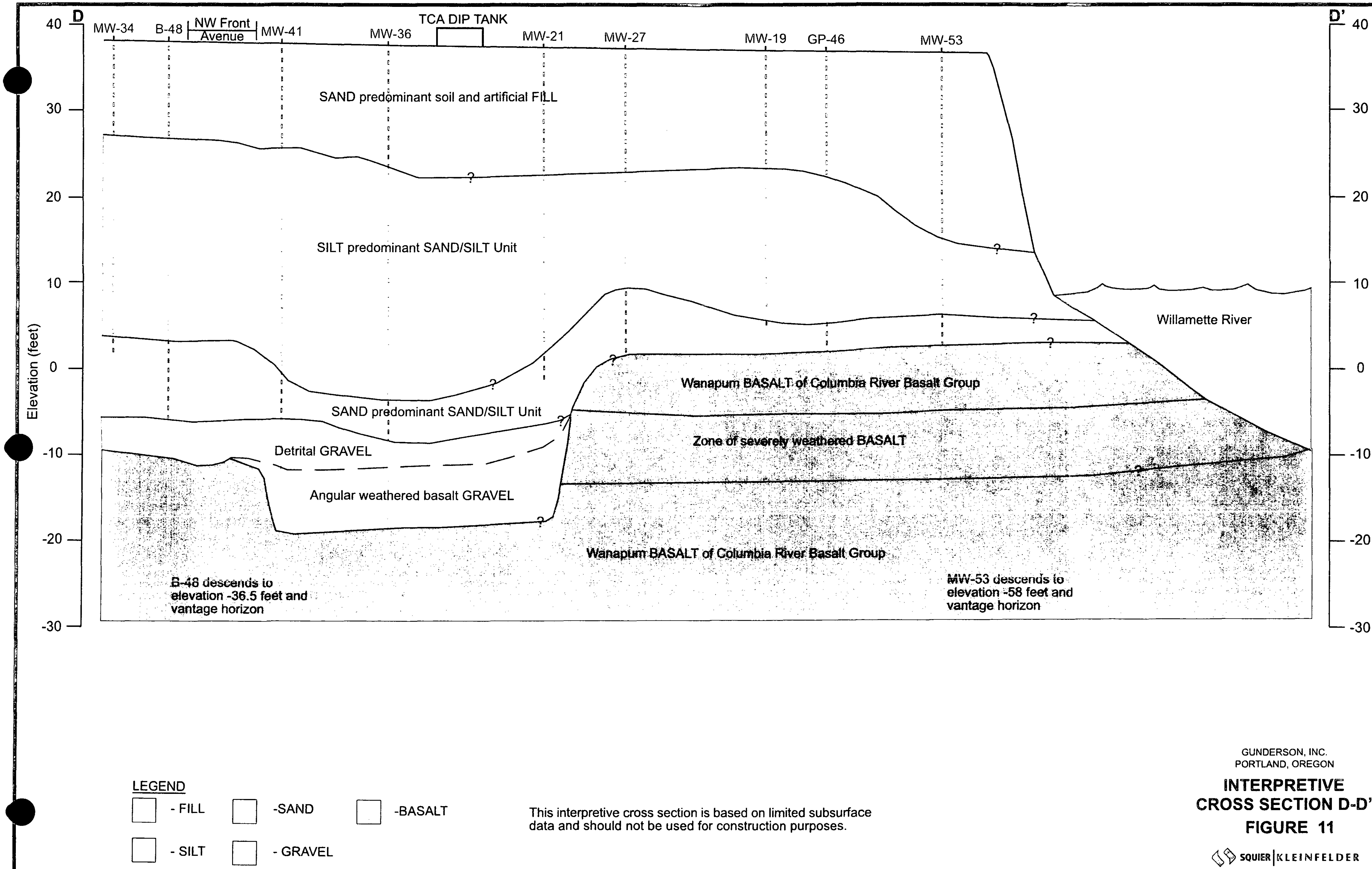

This interpretive cross section is based on limited subsurface data and should not be used for construction purposes.

GUNDERSON, INC.
PORTLAND, OREGON

INTERPRETIVE CROSS SECTION D-D'

FIGURE 11

SQUIER | KLEINFELDER

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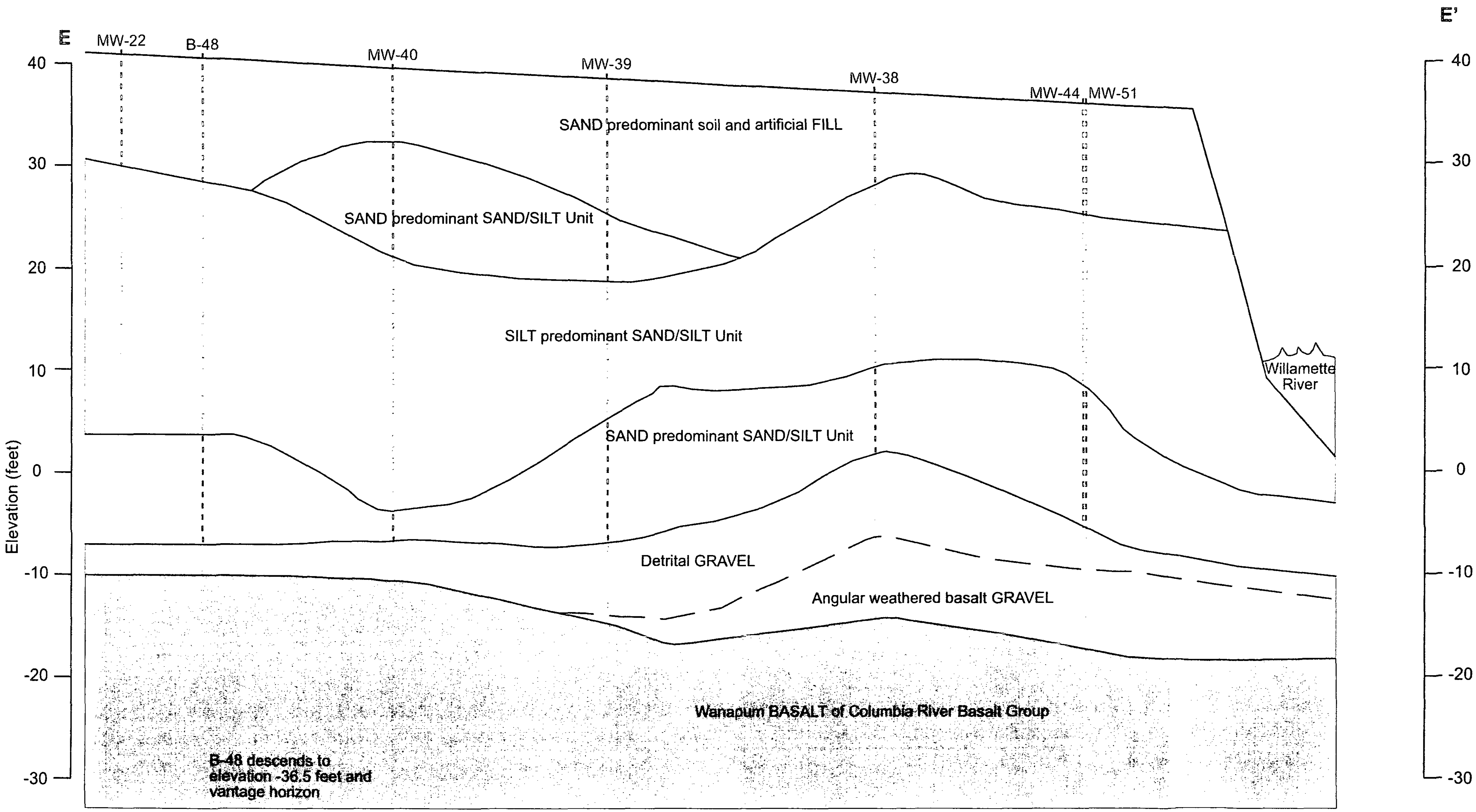

LEGEND

- FILL
-SAND
-BASALT
- SILT
- GRAVEL

This interpretive cross section is based on limited subsurface data and should not be used for construction purposes.

GUNDERSON, INC.
PORTLAND, OREGON

INTERPRETIVE CROSS SECTION E-E'
FIGURE 12

SQUIER | KLEINFELDER

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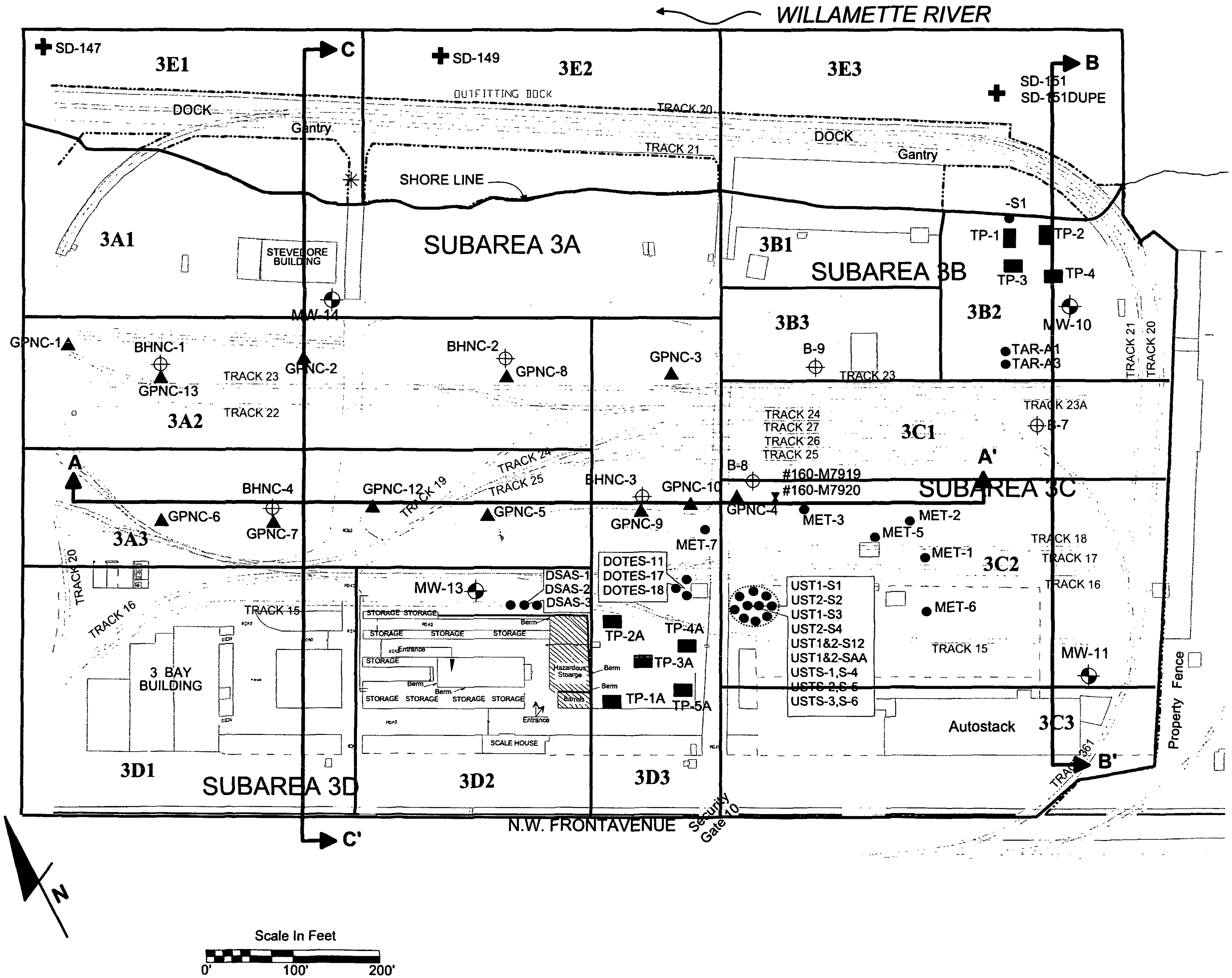

LEGEND

- Property Boundary
- MW-22 Existing Monitoring Wells by Squier Associates
- Soil Borings
- Air Sample
- Approximate UST Excavation
- Surface Soil Grab Sample
- River Level Reference Point
- Test Pit Locations
- Geoprobe
- Sediment Sample
- B / B' Cross Section Alignment

JAMES RIVER CORPORATION

GUNDERSON, INC. PROPERTY
4350 N.W. FRONT AVENUE
PORTLAND, OREGON

PREVIOUS INVESTIGATIONS SAMPLING LOCATIONS AND CROSS SECTION ALIGNMENTS

FIGURE 13

SQUIER | KLEINFELDER

NOTE: Features shown are for illustrative purposes only and are approximate

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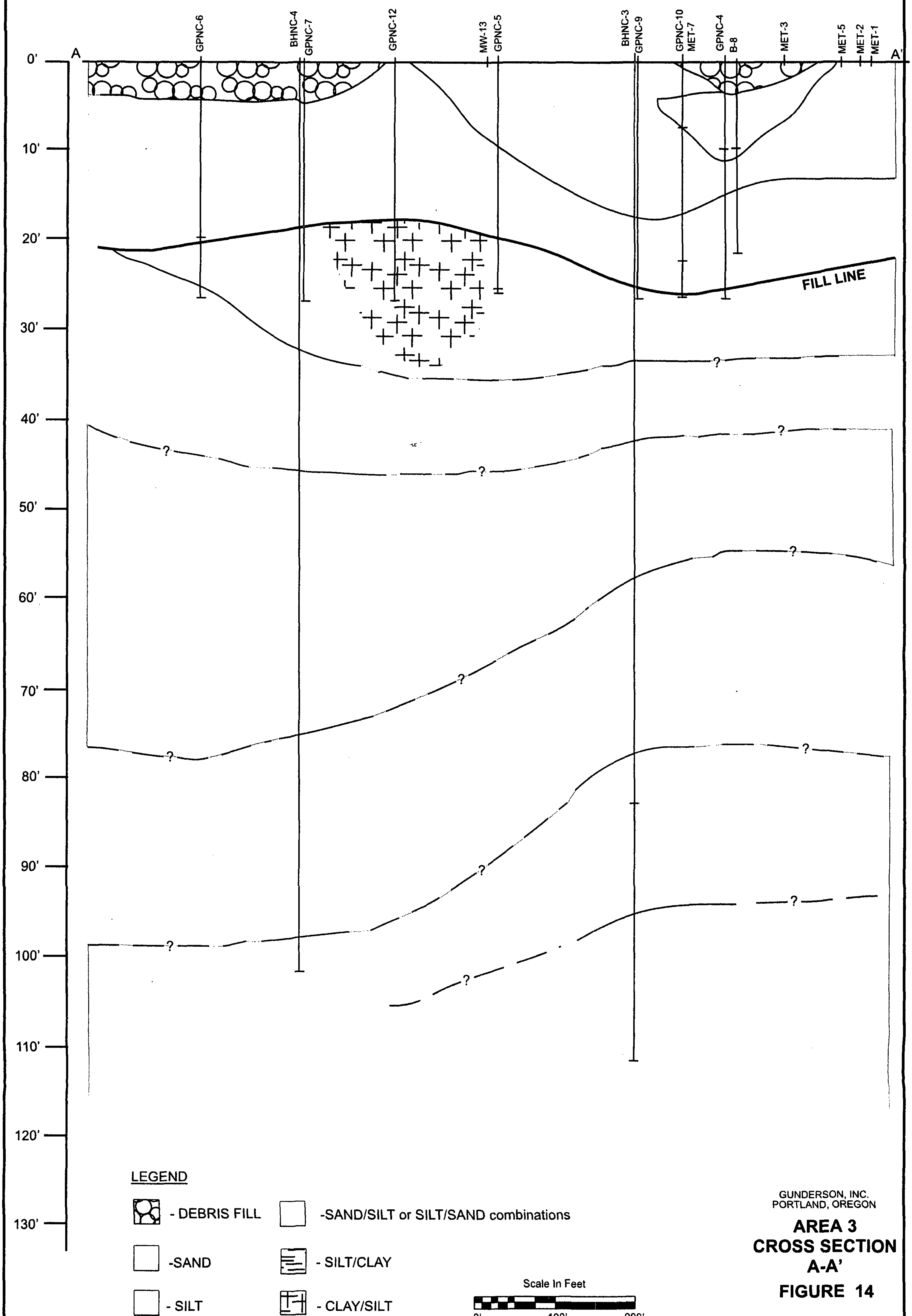

GUNDERSON, INC.
PORTLAND, OREGON

AREA 3
CROSS SECTION
A-A'

FIGURE 14

SQUIER | KLEINFELDER

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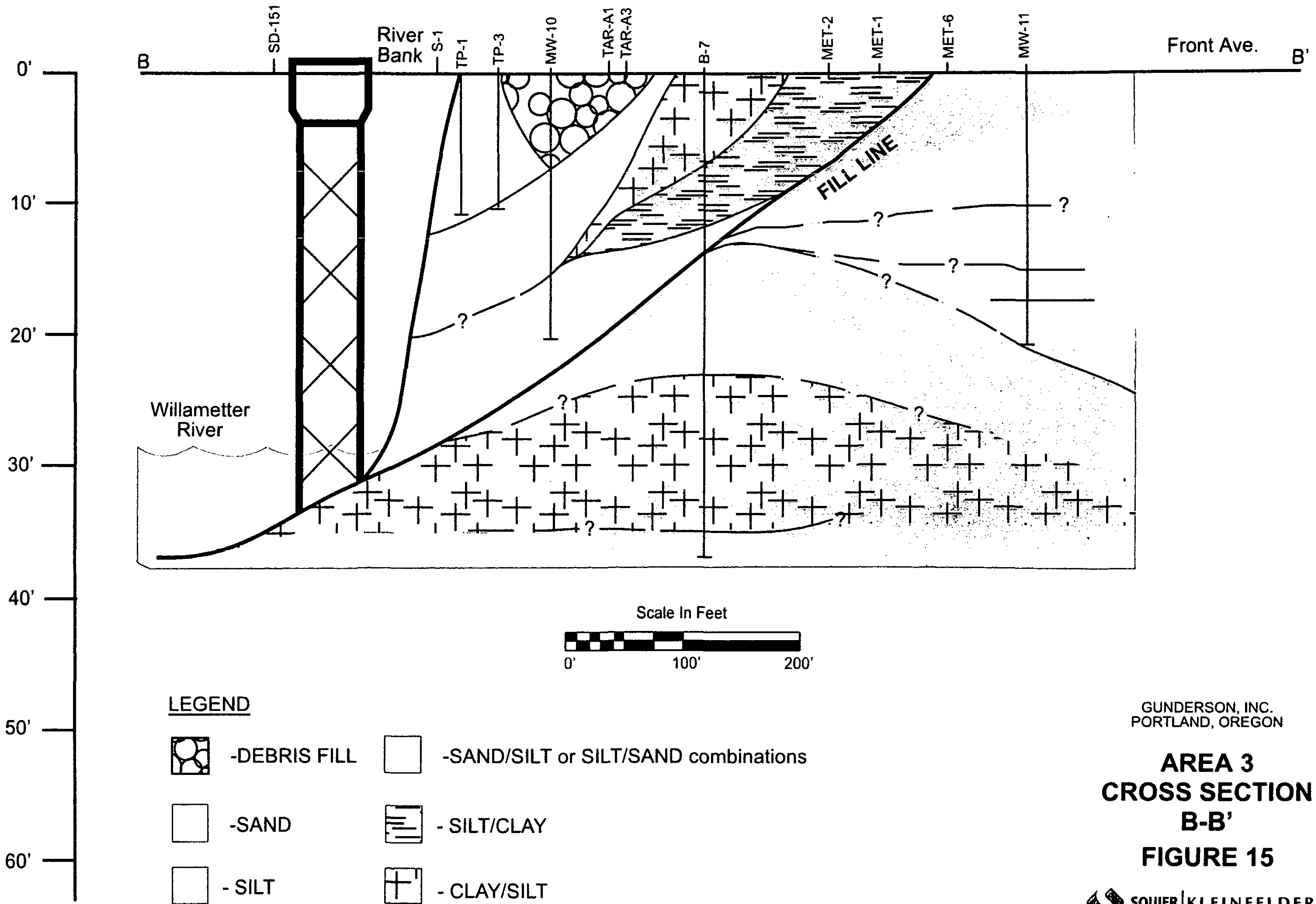

GUNDERSON, INC.
PORTLAND, OREGON

AREA 3 CROSS SECTION B-B'

FIGURE 15

SQUIER | KLEINFELDER

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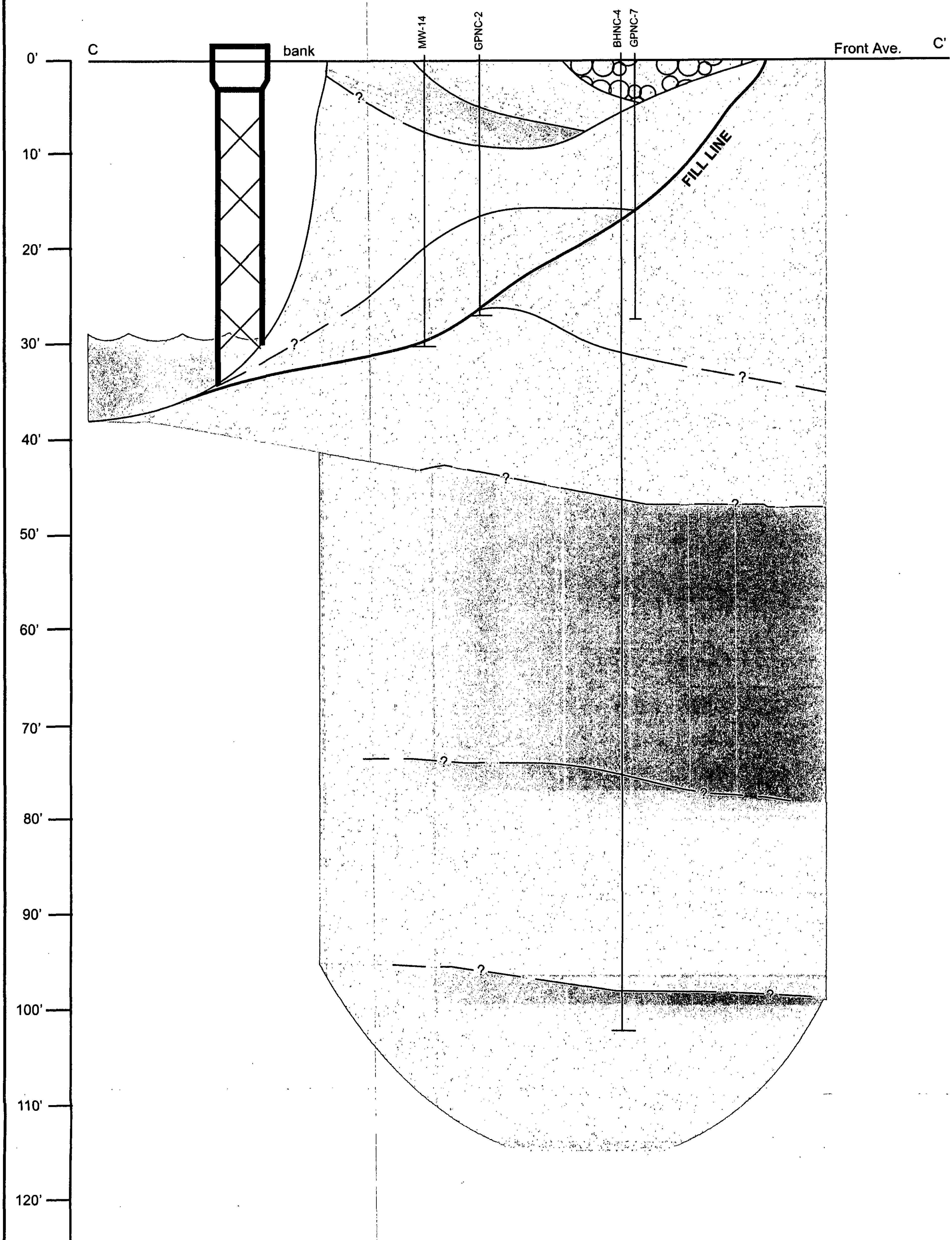


LEGEND

-DEBRIS FILL

-SAND/SILT or SILT/SAND combinations

-SAND

- SILT/CLAY

- SILT

- CLAY/SILT

Scale In Feet

0' 100' 200'

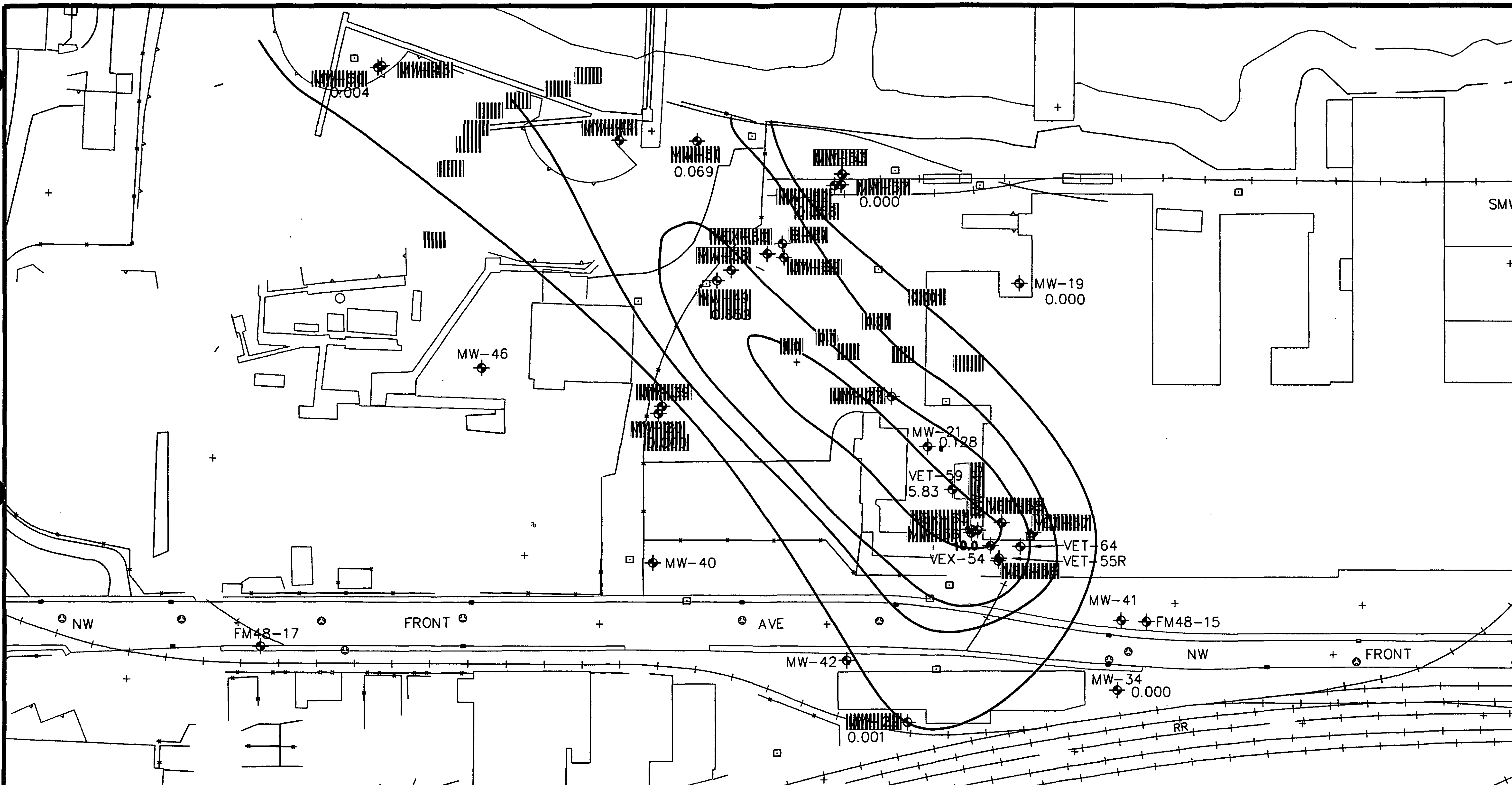
GUNDERSON, INC.
PORTLAND, OREGON

AREA 3
CROSS SECTION
C-C'

FIGURE 16

SQUIER | KLEINFELDER

Drawn by: TLK	Checked by:	Graphics Check:	File: L:\2004\Projects\Squier\90445.33	Date: 07/04	Job. No. 90445.33



MW-31 Monitoring Wells by Squier Associates

13.04 Elevation of ground water in feet above mean sea level

13.04* Water elevation not used in calculation of contour model

MW-26 Abandoned Monitoring Well Location

Building

Rail Line

Fence Line

10 HVOC Isopleths

NM Not Measured

100' 50' 0' 100'

SCALE 1"=100'

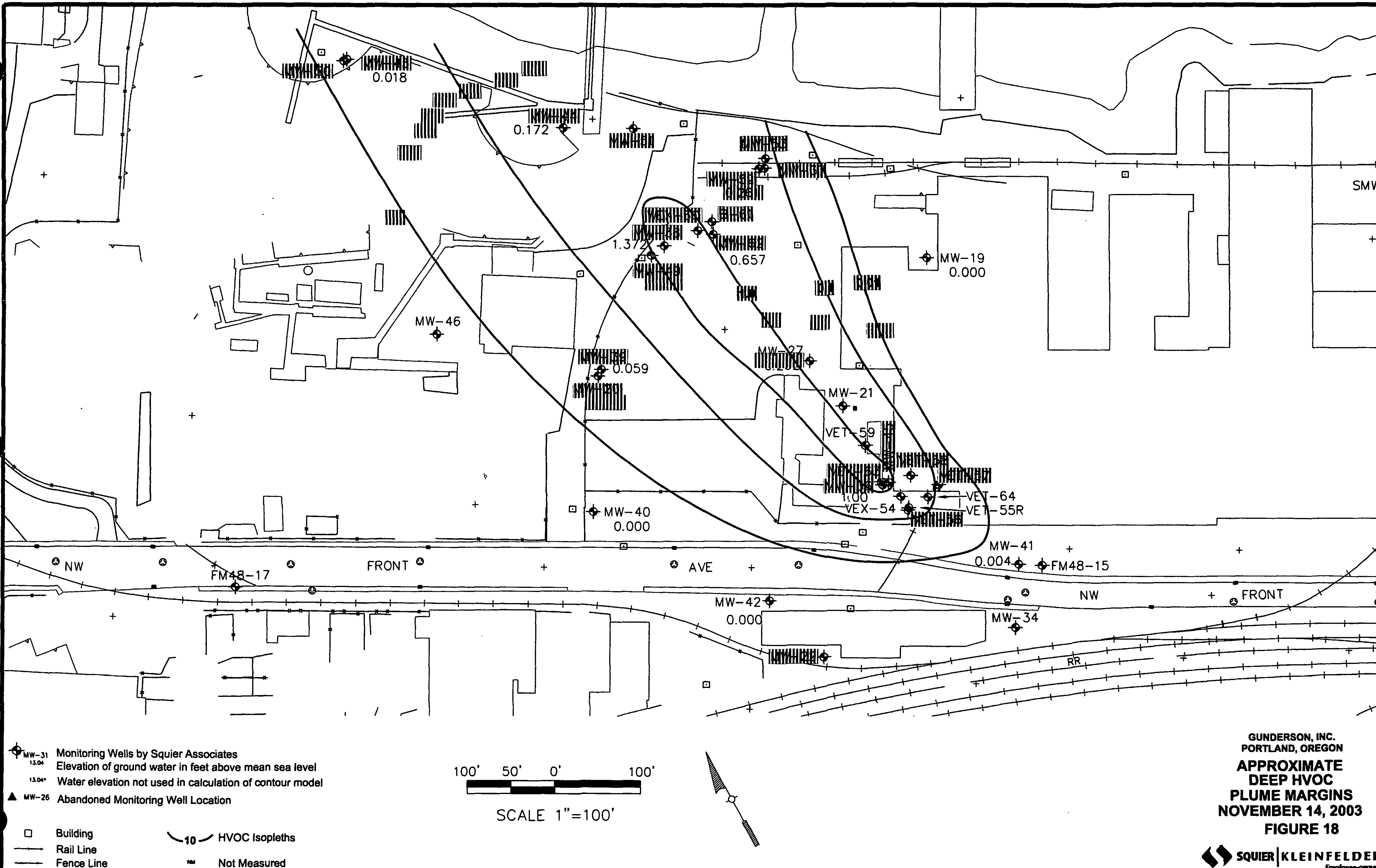
GUNDERSON, INC.
PORTLAND, OREGON

APPROXIMATE SHALLOW HVOC PLUME MARGINS NOVEMBER 14, 2003

FIGURE 17

SQUIER | KLEINFELDER
Employee-owned

Drawn by: TLK	Checked by:	File: L:\2004\PROJECTS\SQUIER\90445.33	Date: 01/04	Job No. 90445.33



GUNDERSON, INC.
PORTLAND, OREGON

APPROXIMATE DEEP HVOC PLUME MARGINS NOVEMBER 14, 2003

FIGURE 18

SQUIER | KLEINFELDER *Employee-owned*

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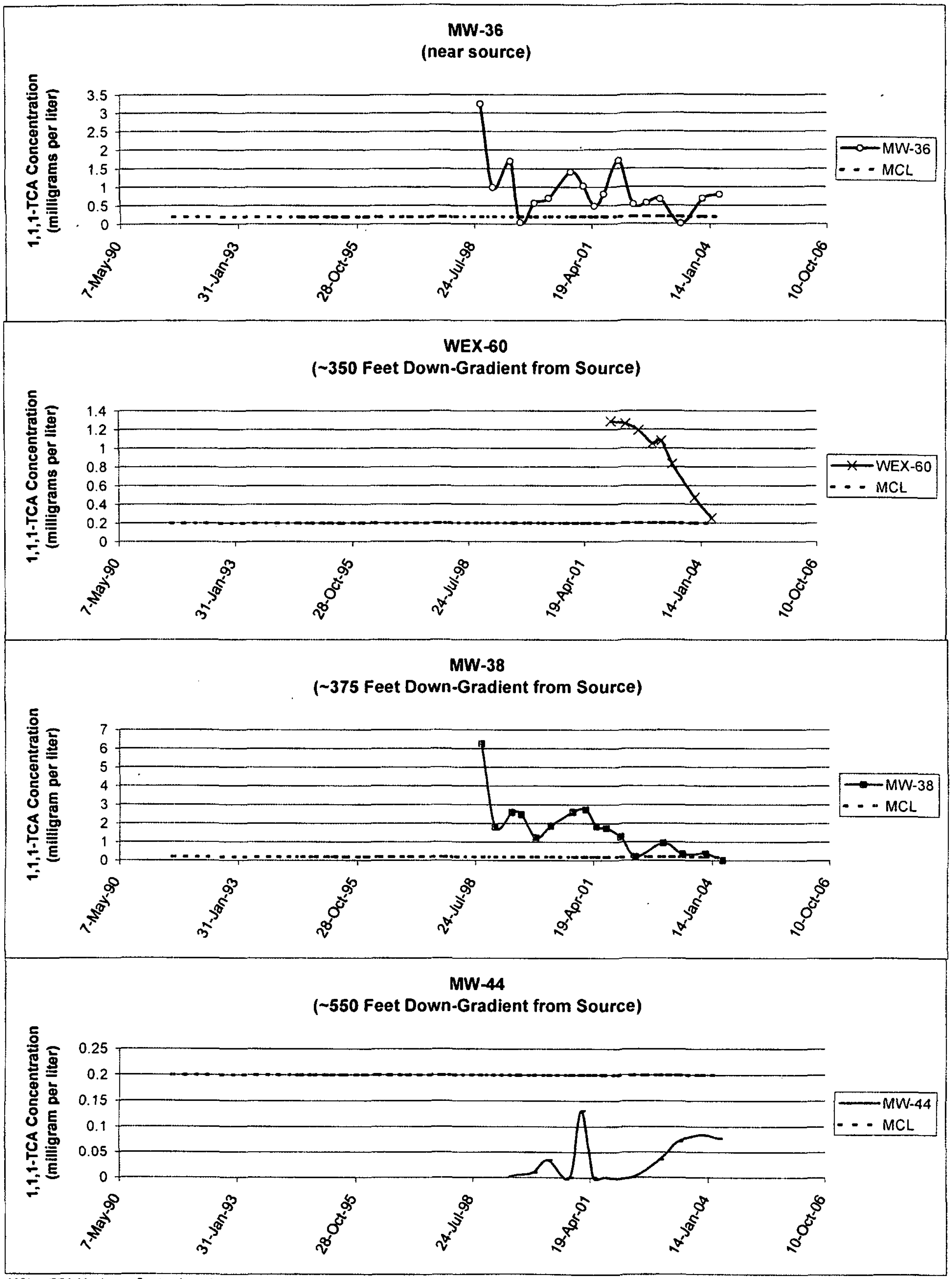
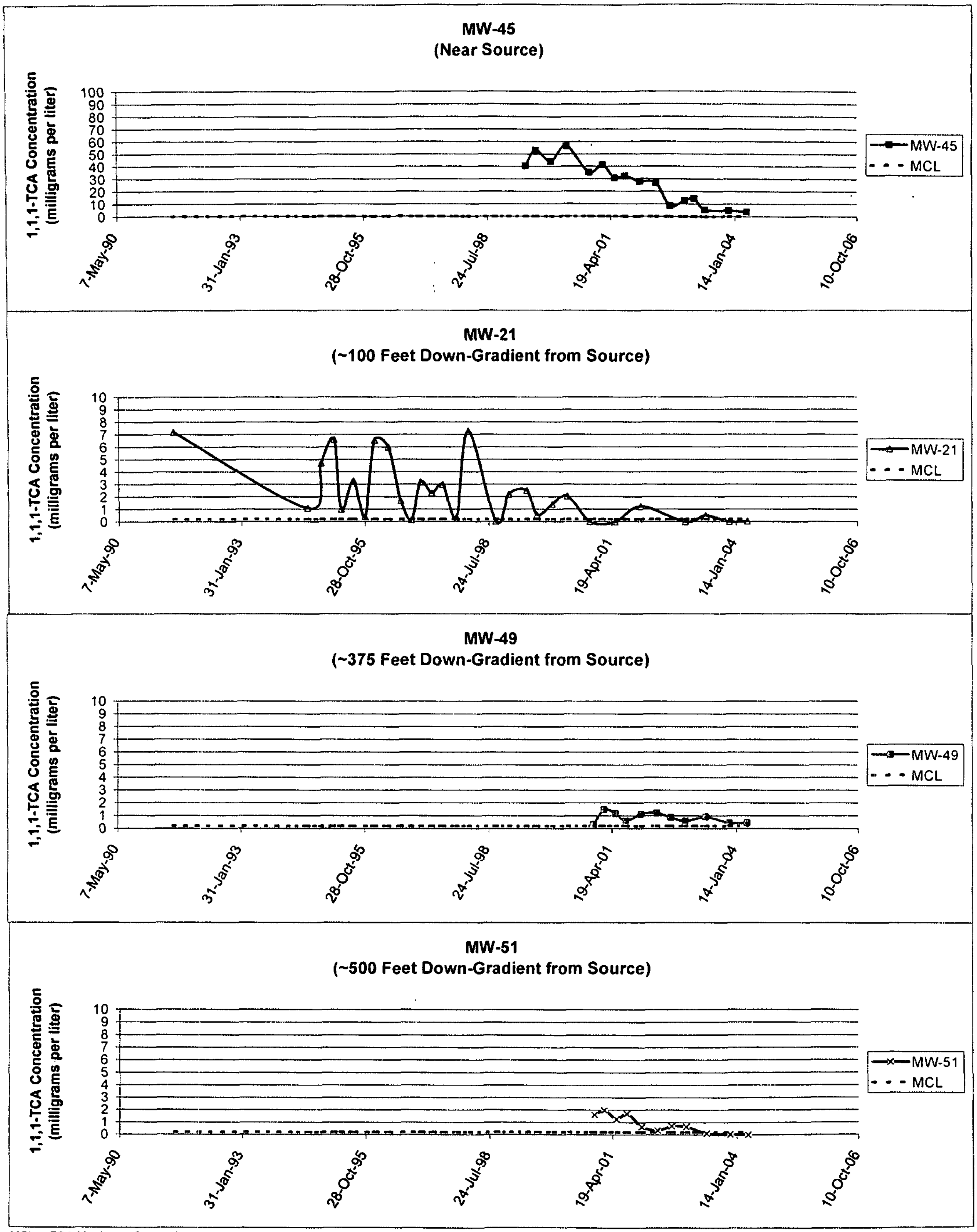
1,1,1 - Trichloroethane Concentrations in Deep Groundwater



MCL = EPA Maximum Contaminant Level

FIGURE 19

1,1,1 - Trichloroethane Concentrations in Shallow Groundwater



MCL = EPA Maximum Contaminant Level

TABLES

Gunderson, Inc. #1155

Table 1. Potential Sources and Transport Pathways Assessment

Last Updated: September 17, 2004

Potential Sources	Media Impacted					COIs																		Potential Complete				
						TPH			VOCs																			
Description of Potential Source	Surface Soil	Subsurface Soil	Groundwater	Catch Basin Solids	River Sediment	Gasoline-Range	Diesel - Range	Heavier - Range	Petroleum-Related (e.g. BTEX)	VOCs	Chlorinated VOCs	SVOCs	PAHs	Phthalates	Phenolics	Metals	PCBs	Herbicides and Pesticides	Dioxins/Furans	Butyltins	*(Others -List)*	*(Others -List)*	*(Others -List)*	Overland Transport	Groundwater	Direct Discharge - Overwater	Direct Discharge - Storm/Wastewater	Riverbank Erosion
Upland Areas																												
Fromer 1,1,1-Trichloroethane Tank	✓	✓	✓								✓														✓			
Former Marine Barge Paint Storage		✓								✓						✓												
Marine Barge Paint and Blast Area	✓	✓		✓						✓						✓				✓				✓		✓	✓	
Fromer Ship Dismantlers Access Gully	✓	✓	✓	✓	✓			✓								✓	✓							✓	✓		✓	
Former Auto Salvage Yard	✓	✓	✓	✓			✓	✓					✓			✓	✓							✓	✓		✓	
Hazardous Materials Storage Area	✓									✓																		
Overwater Areas																												
Marine Barge Launchways										✓																		
Railcar Storage on Outfitting Dock										✓																		
Other Areas/Other Issues																												

Notes:

[1] All information provided in this table is referenced in the site summaries. If information is not available or inconclusive, a ? may be used, as appropriate. No new information is provided in this table.

✓ = Source, COI are present or current or historic pathway is determined to be complete or potentially complete.

? = There is not enough information to determine if source or COI is present or if pathway is complete.

Blank = Source, COI and historic and current pathways have been investigated and shown to be not present or incomplete.

UST	Underground storage tank
AST	Above-ground storage tank
TPH	Total petroleum hydrocarbons
VOCs	Volatile organic compounds
SVOCs	Semivolatile organic compounds
PAHs	Polycyclic aromatic hydrocarbons
BTEX	Benzene, toluene, ethylbenzene, and xylenes
PCBs	Polychorinated biphenols

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Aroclor 1016 (ug/kg)	16	0	0						3.9 U	950 U	80.3	6.63 U	67 U
surface	Aroclor 1242 (ug/kg)	16	0	0						2.83 U	950 U	78.4	3.28 U	67 U
surface	Aroclor 1248 (ug/kg)	16	11	68.8	32.6	508	198	154	407	8.5 U	950 U	209	106	508
surface	Aroclor 1254 (ug/kg)	16	12	75	14	159	71.4	68.3	115	14	950 U	124	67 U	159
surface	Aroclor 1260 (ug/kg)	16	9	56.3	13.4	97.5	47.2	49.5	74	3.21 U	950 U	98.6	40 U	97.5
surface	Aroclor 1262 (ug/kg)	9	0	0						3.14 U	4.46 U	3.46	3.32 U	3.64 U
surface	Aroclor 1268 (ug/kg)	9	0	0						3.14 U	4.46 U	3.46	3.32 U	3.64 U
surface	Aroclor 1221 (ug/kg)	16	0	0						2.26 U	1900 U	155	2.62 U	134 U
surface	Aroclor 1232 (ug/kg)	16	0	0						3.84 U	950 U	79	4.29 U	67 U
surface	Polychlorinated biphenyls (ug/kg)	18	16	88.9	14	640 A	223	146 A	606 A	14	1900 UA	312	146 A	640 A
surface	Butyltin ion (ug/l)	1	0	0						0.06 U	0.06 U	0.06	0.06 U	0.06 U
surface	Butyltin ion (ug/kg)	10	3	30	4.94	20.3	10.8	7.11	7.11	1.49 U	20.3	6.82	5.7 U	7.11
surface	Dibutyltin ion (ug/l)	2	0	0						0.06 U	0.06 U	0.06	0.06 U	0.06 U
surface	Dibutyltin ion (ug/kg)	10	3	30	3.98	86	31.6	4.73	4.73	2.24 U	86	13.1	5.7 U	5.8 U
surface	Tributyltin ion (ug/l)	2	0	0						0.02 U	0.02 UJ	0.02	0.02 U	0.02 U
surface	Tributyltin ion (ug/kg)	10	7	70	3.66	1830	300	9.8	230	2.99 U	1830	212	5.7 U	230
surface	Tetrabutyltin (ug/l)	2	0	0						0.02 U	0.02 U	0.02	0.02 U	0.02 U
surface	Tetrabutyltin (ug/kg)	10	0	0						2.24 U	5.8 U	4.39	5.7 U	5.8 U
surface	Total solids (percent)	12	12	100	44.7	82.8	69.6	73.08	82	44.7	82.8	69.6	73.08	82
surface	Total organic carbon (percent)	21	21	100	0.154	2.45	1.35	1.5	2.3	0.154	2.45	1.35	1.5	2.3
surface	Nitrate (mg/kg)	2	0	0						0 U	0 U	U	0 U	0 U
surface	Nitrite (mg/kg)	2	0	0						0 U	0 U	U	0 U	0 U
surface	Cyanide (mg/kg)	2	2	100	170	180	175	170	170	170	180	175	170	170
surface	Ammonia (mg/kg)	2	2	100	170	260	215	170	170	170	260	215	170	170
surface	Total kjeldahl nitrogen (mg/kg)	2	2	100	1320	1490	1410	1320	1320	1320	1490	1410	1320	1320
surface	Phosphorus (mg/kg)	2	2	100	60	270	165	60	60	60	270	165	60	60
surface	Chemical oxygen demand (mg/kg)	2	2	100	70000	76000	73000	70000	70000	70000	76000	73000	70000	70000
surface	Gravel (percent)	9	8	88.9	0.09	0.62	0.274	0.2	0.41	0.01 U	0.62	0.244	0.2	0.41
surface	Sand (percent)	8	8	100	8.9	30.54	16.1	13.98	18.94	8.9	30.54	16.1	13.98	18.94
surface	Very coarse sand (percent)	2	2	100	0.63	0.87	0.75	0.63	0.63	0.63	0.87	0.75	0.63	0.63
surface	Coarse sand (percent)	2	2	100	0.95	1.8	1.38	0.95	0.95	0.95	1.8	1.38	0.95	0.95
surface	Medium sand (percent)	2	2	100	2.09	4.4	3.25	2.09	2.09	2.09	4.4	3.25	2.09	2.09
surface	Fine sand (percent)	2	2	100	6.51	8.43	7.47	6.51	6.51	6.51	8.43	7.47	6.51	6.51
surface	Very fine sand (percent)	2	2	100	15.1	16.3	15.7	15.1	15.1	15.1	16.3	15.7	15.1	15.1
surface	Fines (percent)	8	8	100	69.06	90.96	83.7	85.8	88.08	69.06	90.96	83.7	85.8	88.08
surface	Silt (percent)	8	8	100	61.9	82.57	74.6	76.55	77.25	61.9	82.57	74.6	76.55	77.25
surface	Coarse silt (percent)	2	2	100	31.8	35.4	33.6	31.8	31.8	31.8	35.4	33.6	31.8	31.8
surface	Medium silt (percent)	2	2	100	17.2	17.6	17.4	17.2	17.2	17.2	17.6	17.4	17.2	17.2
surface	Fine silt (percent)	2	2	100	8.87	9.04	8.96	8.87	8.87	8.87	9.04	8.96	8.87	8.87
surface	Very fine silt (percent)	2	2	100	4.46	5.79	5.13	4.46	4.46	4.46	5.79	5.13	4.46	4.46
surface	Clay (percent)	8	8	100	7.16	11.27	9.05	8.64	10.14	7.16	11.27	9.05	8.64	10.14
surface	8-9 Phi clay (percent)	2	2	100	2.07	2.81	2.44	2.07	2.07	2.07	2.81	2.44	2.07	2.07
surface	9-10 Phi clay (percent)	2	2	100	1.55	1.64	1.6	1.55	1.55	1.55	1.64	1.6	1.55	1.55
surface	>10 Phi clay (percent)	2	2	100	1.66	2.45	2.06	1.66	1.66	1.66	2.45	2.06	1.66	1.66
surface	Dalapon (ug/kg)	11	0	0						0.135 U	96 U	15	0.152 U	68 U
surface	Dicamba (ug/kg)	11	0	0						0.138 U	3.3 U	0.73	0.156 U	3.3 UJ
surface	MCPA (ug/kg)	11	0	0						0.264 U	3300 U	600	0.298 U	3300 U
surface	Dichloroprop (ug/kg)	11	0	0						0.223 U	6.6 U	1.4	0.251 U	6.5 UJ

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations					Detected and Nondetected Concentrations				
					Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
surface	2,4-D (ug/kg)	11	0	0						0.234 U	6.6 U	1.41	0.264 U	6.5 UJ
surface	Silvex (ug/kg)	11	0	0						0.226 U	43 U	4.27	0.254 U	1.6 UJ
surface	2,4,5-T (ug/kg)	11	0	0						0.276 U	58 U	5.68	0.311 U	1.6 UJ
surface	2,4-DB (ug/kg)	11	0	0						0.169 U	33 U	6.16	0.19 U	33 U
surface	Dinoseb (ug/kg)	11	0	0						0.193 U	3.3 U	0.781	0.218 U	3.3 UJ
surface	MCPP (ug/kg)	11	0	0						0.118 U	3300 U	600	0.133 U	3300 U
surface	Aluminum (mg/l)	2	2	100	0.03	0.69	0.36	0.03	0.03	0.03	0.69	0.36	0.03	0.03
surface	Aluminum (mg/kg)	19	19	100	5430	42100	23200	28600	41000	5430	42100	23200	28600	41000
surface	Antimony (mg/l)	2	0	0						0.05 U	0.05 U	0.05	0.05 U	0.05 U
surface	Antimony (mg/kg)	21	17	81	1 J	47.7	6.63	2.52 J	13	1 J	47.7	6.36	5 UJ	8 J
surface	Arsenic (mg/l)	2	2	100	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
surface	Arsenic (mg/kg)	25	17	68	2.3	79.6	11.8	5.66	28.5	2.3	79.6	9.74	5.65	11.3
surface	Cadmium (mg/l)	2	0	0						0.002 U	0.002 U	0.002	0.002 U	0.002 U
surface	Cadmium (mg/kg)	25	19	76	0.0638 J	1	0.519	0.5	0.897	0.0638 J	1	0.541	0.5	1 U
surface	Chromium (mg/l)	2	0	0						0.005 U	0.005 U	0.005	0.005 U	0.005 U
surface	Chromium (mg/kg)	25	25	100	14	71	36.6	36.2	54	14	71	36.6	36.2	54
surface	Copper (mg/l)	2	0	0						0.002 U	0.002 U	0.002	0.002 U	0.002 U
surface	Copper (mg/kg)	25	25	100	31	400	72.2	52	98.9 B	31	400	72.2	52	98.9 B
surface	Lead (mg/l)	2	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Lead (mg/kg)	25	25	100	14	343	88.2	67.3 B	204	14	343	88.2	67.3 B	204
surface	Manganese (mg/l)	2	2	100	13.5	15.2	14.4	13.5	13.5	13.5	15.2	14.4	13.5	13.5
surface	Manganese (mg/kg)	14	14	100	367	1100	663	635	853	367	1100	663	635	853
surface	Mercury (mg/l)	2	0	0						0.0001 U	0.0001 U	0.0001	0.0001 U	0.0001 U
surface	Mercury (mg/kg)	25	23	92	0.04	0.453	0.163	0.116	0.318 J	0.0103 U	0.453	0.153	0.11	0.318 J
surface	Nickel (mg/l)	2	0	0						0.01 U	0.01 U	0.01	0.01 U	0.01 U
surface	Nickel (mg/kg)	25	25	100	15	65.6	26.7	23.2	38	15	65.6	26.7	23.2	38
surface	Selenium (mg/l)	2	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Selenium (mg/kg)	25	9	36	0.614 J	15	11.1	12	14	0 U	15	4.3	0.508 U	14
surface	Silver (mg/l)	2	0	0						0.0002 U	0.0002 U	0.0002	0.0002 U	0.0002 U
surface	Silver (mg/kg)	23	19	82.6	0.0855 J	0.9	0.441	0.349 J	0.9	0.0855 J	0.9	0.436	0.387 J	0.8
surface	Thallium (mg/l)	2	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Thallium (mg/kg)	12	7	58.3	8	15	11.6	11	14	0.373 U	15	7.3	8	14
surface	Zinc (mg/l)	2	2	100	0.009	0.01	0.0095	0.009	0.009	0.009	0.01	0.0095	0.009	0.009
surface	Zinc (mg/kg)	25	25	100	85	1140	231	199 B	419	85	1140	231	199 B	419
surface	Barium (mg/l)	2	2	100	0.139	0.187	0.163	0.139	0.139	0.139	0.187	0.163	0.139	0.139
surface	Barium (mg/kg)	12	12	100	114	284	179	183	203	114	284	179	183	203
surface	Beryllium (mg/l)	2	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Beryllium (mg/kg)	12	12	100	0.443	1.19	0.636	0.6	0.7	0.443	1.19	0.636	0.6	0.7
surface	Calcium (mg/l)	2	2	100	136	145	141	136	136	136	145	141	136	136
surface	Calcium (mg/kg)	8	8	100	5960 J	8740 J	8170	8460	8590 J	5960 J	8740 J	8170	8460	8590 J
surface	Cobalt (mg/l)	2	2	100	0.019	0.02	0.0195	0.019	0.019	0.019	0.02	0.0195	0.019	0.019
surface	Cobalt (mg/kg)	10	10	100	14.8	20	17.9	18.5	19.8	14.8	20	17.9	18.5	19.8
surface	Iron (mg/l)	2	2	100	24.2	43.4	33.8	24.2	24.2	24.2	43.4	33.8	24.2	24.2
surface	Iron (mg/kg)	10	10	100	16000	47200	37900	42900	47000	16000	47200	37900	42900	47000
surface	Magnesium (mg/l)	2	2	100	46.6	48.4	47.5	46.6	46.6	46.6	48.4	47.5	46.6	46.6
surface	Magnesium (mg/kg)	8	8	100	5240	7530	7030	7250	7350	5240	7530	7030	7250	7350
surface	Potassium (mg/l)	2	2	100	3.6	5.1	4.35	3.6	3.6	3.6	5.1	4.35	3.6	3.6
surface	Potassium (mg/kg)	8	8	100	1190	1330	1270	1260	1330	1190	1330	1270	1260	1330

DO NOT QUOTE OR CITE.
This document is currently under review by US EPA.

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Sodium (mg/l)	2	2	100	14.6	14.8	14.7	14.6	14.6	14.6	14.8	14.7	14.6	14.6
surface	Sodium (mg/kg)	8	8	100	693	1080	1000	1060	1080	693	1080	1000	1060	1080
surface	Titanium (mg/kg)	6	6	100	1840	2160	1990	1900	2120	1840	2160	1990	1900	2120
surface	Vanadium (mg/l)	2	2	100	0.004	0.005	0.0045	0.004	0.004	0.004	0.005	0.0045	0.004	0.004
surface	Vanadium (mg/kg)	8	8	100	86.3	115	106	106	113	86.3	115	106	106	113
surface	2-Methylnaphthalene (ug/kg)	23	8	34.8	12.4 J	210	75.3	33.3	147	2.82 U	6600 U	610	20 U	1650 U
surface	Acenaphthene (ug/kg)	23	9	39.1	13.5 J	515	104	35	189	8.08 U	515	54.9	20 U	67 U
surface	Acenaphthylene (ug/kg)	23	5	21.7	12.3 J	51.2	23.9	16.5	23.3	6.85 U	335 U	35.9	19 U	59 U
surface	Anthracene (ug/kg)	23	13	56.5	13.5 J	834	106	23	170	5.71 U	834	69.6	20 U	93.4
surface	Fluorene (ug/kg)	23	9	39.1	9.02 J	616	102	33	122	7.14 U	616	53.3	19 J	67 U
surface	Naphthalene (ug/kg)	23	7	30.4	8.93 J	132	45	33.7	66.1	7.64 U	335 U	41.6	19 U	67 U
surface	Phenanthrene (ug/kg)	23	21	91.3	22.3	4820	350	62	290	13.4 U	4820	323	62	290
surface	Low Molecular Weight PAH (ug/kg)	23	21	91.3	25 A	1186 A	235	157 A	671.5 A	13.4 UA	1186 A	218	104 A	671.5 A
surface	Dibenz(a,h)anthracene (ug/kg)	23	2	8.7	19 J	28 JT	23.5	19 J	19 J	3.56 U	335 U	28.9	19 U	28 JT
surface	Benz(a)anthracene (ug/kg)	23	17	73.9	22	1880	204	69.4	405	9.32 U	1880	156	58	265
surface	Benzo(a)pyrene (ug/kg)	23	16	69.6	21.3	1670	197	55	499	8.97 U	1670	143	41	254
surface	Benzo(b)fluoranthene (ug/kg)	14	13	92.9	21.2	1500	197	59	370 T	21.2	1500	188	59	370 T
surface	Benzo(g,h,i)perylene (ug/kg)	23	13	56.5	22	1140	148	42	256	2.52 U	1140	89.1	28	113
surface	Benzo(k)fluoranthene (ug/kg)	14	13	92.9	20	1540	179	38	260 T	20	1540	171	38	260 T
surface	Chrysene (ug/kg)	23	17	73.9	19.3	2080	253	86	419	8.97 U	2080	192	68	400 T
surface	Fluoranthene (ug/kg)	23	22	95.7	20.6	4900	432	143	737	20.6	4900	416	143	737
surface	Indeno(1,2,3-cd)pyrene (ug/kg)	23	13	56.5	20.9	974	122	46	118	3.56 U	974	74.6	26 T	81.4
surface	Pyrene (ug/kg)	23	23	100	31.9	3950	359	140	600 J	31.9	3950	359	140	600 J
surface	Benzo(b+k)fluoranthene (ug/kg)	21	15	71.4	44 A	3040 A	360	111 A	603	6.72 U	3040 A	262	97 A	397
surface	High Molecular Weight PAH (ug/kg)	23	23	100	71.1 A	19600 A	1670	505 A	3020	71.1 A	19600 A	1670	505 A	3020
surface	Polycyclic Aromatic Hydrocarbons (ug/kg)	23	23	100	71.1 A	26400 A	2150	667 A	3778 A	71.1 A	26400 A	2150	667 A	3778 A
surface	Polychlorinated naphthalenes (ug/kg)	2	0	0						0 U	0 U	U	0 U	0 U
surface	4,4'-DDD (ug/kg)	14	13	92.9	2	82.7	24.8	14.1	54.5	2	95 U	29.9	14.1	82.7
surface	2,4'-DDD (ug/kg)	11	6	54.5	6.07 P	24	13	9.42 P	17.5 P	0.62 U	24	8.95	7.46 U	17.5 P
surface	2,4'-DDE (ug/kg)	11	2	18.2	7.77 P	8.21 P	7.99	7.77 P	7.77 P	3.4 U	8.21 P	5.52	5.16 U	7.77 P
surface	4,4'-DDT (ug/kg)	14	2	14.3	1.4	2.7	2.05	1.4	1.4	0.593 U	95 U	7.96	0.696 U	3.2 U
surface	2,4'-DDT (ug/kg)	11	0	0						0.39 U	7.46 U	4.47	5.16 U	5.79 U
surface	4,4'-DDE (ug/kg)	14	13	92.9	3	124	44	32.9	78.9	3	124	47.7	32.9	95 U
surface	Total of 3 isomers: pp-DDT,-DDD,-DDE (ug/kg)	14	13	92.9	5	178.5 A	69.2	51.4 A	158.1 A	5	178.5 A	71	51.4 A	158.1 A
surface	Aldrin (ug/kg)	14	10	71.4	2	28.6 P	10.9	7	24.2 P	0.6 U	48 U	11.6	6.48 P	28.6 P
surface	alpha-Hexachlorocyclohexane (ug/kg)	12	1	8.33	1.03 J	1.03 J	1.03	1.03 J	1.03 J	0.19 U	48 U	4.68	0.801 U	1.16 U
surface	beta-Hexachlorocyclohexane (ug/kg)	12	7	58.3	1.19 JP	7.03	3.24	2.87	4.91	0.32 U	48 U	6.2	1.58 U	7.03
surface	delta-Hexachlorocyclohexane (ug/kg)	12	0	0						0.19 U	48 U	4.8	0.99 U	1.43 U
surface	gamma-Hexachlorocyclohexane (ug/kg)	14	1	7.14	0.8	0.8	0.8	0.8	0.8	0 U	48 U	4.17	0.899 U	1.42 U
surface	cis-Chlordane (ug/kg)	12	9	75	1.66 JP	18.4 P	10.3	9.39 P	17.3 P	0.27 U	48 U	11.9	9.27	18.4 P
surface	trans-Chlordane (ug/kg)	11	9	81.8	3.46 P	25.3 P	12.2	12.2 P	19.9 P	0.46 U	25.3 P	10.2	8.43	19.9 P
surface	Oxychlordane (ug/kg)	11	0	0						0.4 U	7.46 U	4.58	5.16 U	5.79 U
surface	cis-Nonachlor (ug/kg)	11	1	9.09	6.88	6.88	6.88	6.88	6.88	0.76 U	7.46 U	4.7	5.16 U	6.88
surface	trans-Nonachlor (ug/kg)	11	7	63.6	8.640001 P	19.1	12.9	13.5 P	15.3	0.39 U	19.1	9.44	9.19 P	15.3
surface	Dieldrin (ug/kg)	14	2	14.3	1	2.1	1.55	1	1	0.73 U	95 U	7.74	0.878 U	2.1
surface	alpha-Endosulfan (ug/kg)	12	3	25	1.38 JP	4.95 P	3.41	3.91	3.91	0.19 U	48 U	5.49	1.14 U	4.95 P
surface	beta-Endosulfan (ug/kg)	12	0	0						0.39 U	95 U	8.76	0.997 U	1.44 U
surface	Endosulfan sulfate (ug/kg)	12	3	25	2.06 JP	3.88 JP	3.23	3.74 JP	3.74 JP	0.4 UJ	95 U	9.39	1.05 U	3.88 JP

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Endrin (ug/kg)	14	0	0						0 U	95 U	7.46	0.849 U	1.35 U
surface	Endrin aldehyde (ug/kg)	12	0	0						0.39 U	95 U	8.83	1.05 U	1.52 U
surface	Endrin ketone (ug/kg)	12	0	0						0.39 U	95 U	8.55	0.725 U	1.05 U
surface	Heptachlor (ug/kg)	14	0	0						0 U	48 U	4.05	0.81 U	1.28 UJ
surface	Heptachlor epoxide (ug/kg)	14	0	0						0 U	48 U	4.09	0.86 U	1.36 U
surface	Methoxychlor (ug/kg)	14	2	14.3	6.1	9	7.55	6.1	6.1	1.9 U	480 U	38	3.59 U	9
surface	Mirex (ug/kg)	2	0	0						1.3 U	1.8 U	1.55	1.3 U	1.3 U
surface	Toxaphene (ug/kg)	12	0	0						14.3 U	4800 U	416	16.8 U	23.4 U
surface	gamma-Chlordane (ug/kg)	1	0	0						48 U	48 U	48	48 U	48 U
surface	Chlordane (cis & trans) (ug/kg)	11	2	18.2	8	10	9	8	8	3.22 U	10	4.73	3.77 U	8
surface	Diazinon (ug/kg)	2	1	50	1	1	1	1	1	0 U	1	0.5	0 U	0 U
surface	Endosulfan (ug/kg)	2	0	0						0 U	0 U	U	0 U	0 U
surface	Ethion (ug/kg)	2	0	0						0 U	0 U	U	0 U	0 U
surface	Malathion (ug/kg)	2	0	0						0 U	0 U	U	0 U	0 U
surface	Methyl parathion (ug/kg)	2	0	0						0 U	0 U	U	0 U	0 U
surface	Methyl trithion (ug/kg)	2	0	0						0 U	0 U	U	0 U	0 U
surface	Parathion (ug/kg)	2	0	0						0 U	0 U	U	0 U	0 U
surface	Trithion (ug/kg)	2	0	0						0 U	0 U	U	0 U	0 U
surface	Diesel fuels (mg/kg)	13	10	76.9	16.2 JV	369 V	150	120 V	265 JV	16.2 JV	369 V	123	73.1 V	265 JV
surface	Gasoline (mg/kg)	4	0	0						20 U	20 U	20	20 U	20 U
surface	Heavy oil (mg/kg)	4	4	100	89	1450	475	117	242	89	1450	475	117	242
surface	Lube Oil (mg/kg)	9	8	88.9	149	734	386	266	681 J	3.22 U	734	344	266	681 J
surface	2,3,4,6-Tetrachlorophenol (ug/kg)	8	0	0						9.63 U	300 U	58.5	11 U	98 U
surface	Tetrachlorophenol (ug/kg)	9	0	0						28.9 U	42.8 U	32.9	31.8 U	34.4 U
surface	2,4,5-Trichlorophenol (ug/kg)	23	0	0						27.5 U	6600 U	637	95 U	1650 U
surface	2,4,6-Trichlorophenol (ug/kg)	23	0	0						20.3 U	6600 U	634	95 U	1650 U
surface	2,4-Dichlorophenol (ug/kg)	23	0	0						16.8 U	6600 U	612	57 U	1650 U
surface	2,4-Dimethylphenol (ug/kg)	23	1	4.35	18.4 J	18.4 J	18.4	18.4 J	18.4 J	16.8 U	20000 U	1760	19.4 U	5000 U
surface	2,4-Dinitrophenol (ug/kg)	23	0	0						36.7 U	40000 U	3600	190 U	10000 U
surface	2-Chlorophenol (ug/kg)	23	0	0						19 U	6600 U	594	23.9 U	1650 U
surface	2-Methylphenol (ug/kg)	23	0	0						18.3 U	6600 U	592	20 U	1650 U
surface	2-Nitrophenol (ug/kg)	23	0	0						21.4 U	6600 U	634	95 U	1650 U
surface	4,6-Dinitro-2-methylphenol (ug/kg)	23	0	0						56.5 U	20000 U	1870	190 U	5000 U
surface	4-Chloro-3-methylphenol (ug/kg)	23	2	8.7	68 J	306	187	68 J	68 J	16.8 U	6600 U	616	38 U	1650 U
surface	4-Methylphenol (ug/kg)	19	12	63.2	45 J	1200	566	730	990	20 U	1200	366	72.4 J	990
surface	4-Nitrophenol (ug/kg)	23	0	0						0.134 U	20000 U	1790	95 U	5000 U
surface	Pentachlorophenol (ug/kg)	23	4	17.4	2.59	8.45	4.54	3.21	3.9	0.175 U	20000 U	1780	95 U	5000 U
surface	Phenol (ug/kg)	25	2	8	250	540	395	250	250	19 U	6600 U	585	33.7 U	1650 U
surface	2,3,4,5-Tetrachlorophenol (ug/kg)	2	0	0						98 U	300 U	199	98 U	98 U
surface	2,3,5,6-Tetrachlorophenol (ug/kg)	2	0	0						98 U	300 U	199	98 U	98 U
surface	3- and 4-Methylphenol Coelution (ug/kg)	4	0	0						1650 U	6600 U	3300	1650 U	3300 U
surface	Dimethyl phthalate (ug/kg)	23	0	0						16.8 U	6600 U	592	19.4 U	1650 U
surface	Diethyl phthalate (ug/kg)	23	0	0						19 U	6600 U	596	27.1 U	1650 U
surface	Dibutyl phthalate (ug/kg)	23	2	8.7	24	185 J	105	24	24	19 U	20000 U	1810	137 U	5000 U
surface	Butylbenzyl phthalate (ug/kg)	23	7	30.4	20	760	213	100	385	19 U	6600 U	653	34.4 U	1650 U
surface	Di-n-octyl phthalate (ug/kg)	23	1	4.35	190	190	190	190	190	19 U	6600 U	608	42.4 U	1650 U
surface	Bis(2-ethylhexyl) phthalate (ug/kg)	23	18	78.3	71	2700	611	300	2650	62.7 U	40000 U	3960	399	10000 U
surface	1,2,4-Trichlorobenzene (ug/kg)	23	0	0						10 UJT	100 U	31	19 U	100 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	1,2-Dichlorobenzene (ug/kg)	23	0	0						2 UJT	100 U	32.1	19 U	100 U
surface	1,3-Dichlorobenzene (ug/kg)	23	0	0						2 UJT	100 U	34.6	22 U	100 U
surface	1,4-Dichlorobenzene (ug/kg)	23	0	0						2 UJT	100 U	35.9	25.1 U	100 U
surface	Azobenzene (ug/kg)	2	0	0						20 U	59 U	39.5	20 U	20 U
surface	Bis(2-chloro-1-methylethyl) ether (ug/kg)	10	0	0						19 U	59 U	23.3	19 U	20 U
surface	2,4-Dinitrotoluene (ug/kg)	23	0	0						19.9 U	10000 U	929	95 U	2500 U
surface	2,6-Dinitrotoluene (ug/kg)	23	0	0						27.5 U	10000 U	933	95 U	2500 U
surface	2-Chloronaphthalene (ug/kg)	23	0	0						4.58 U	6600 U	586	19 U	1650 U
surface	2-Nitroaniline (ug/kg)	23	0	0						19.9 U	6600 U	634	95 U	1650 U
surface	3,3'-Dichlorobenzidine (ug/kg)	23	0	0						16.8 U	20000 U	1800	95 U	5000 U
surface	3-Nitroaniline (ug/kg)	23	0	0						26 U	20000 U	1810	110 U	5000 U
surface	4-Bromophenyl phenyl ether (ug/kg)	23	0	0						19 U	6600 U	593	21.2 U	1650 U
surface	4-Chloroaniline (ug/kg)	23	0	0						14.2 UJ	40000 U	3520	57 U	10000 U
surface	4-Chlorophenyl phenyl ether (ug/kg)	23	0	0						19 U	6600 U	595	26.8 U	1650 U
surface	4-Nitroaniline (ug/kg)	23	0	0						26 U	6600 U	636	95 U	1650 U
surface	Aniline (ug/kg)	11	0	0						20 U	113 UJ	78.4	81.6 UJ	91 UJ
surface	Benzoic acid (ug/kg)	23	1	4.35	276 J	276 J	276	276 J	276 J	52 U	20000 U	1870	190 U	5000 U
surface	Benzyl alcohol (ug/kg)	23	0	0						19 U	6600 U	612	34.3 U	1650 U
surface	Bis(2-chloroethoxy) methane (ug/kg)	23	0	0						18.3 U	6600 U	592	20 U	1650 U
surface	Bis(2-chloroethyl) ether (ug/kg)	23	0	0						29.2 UJ	6600 U	607	38 U	1650 U
surface	Carbazole (ug/kg)	19	3	15.8	10 JT	50 T	27.7	23	23	10 JT	88.3 U	43.6	50 T	71 U
surface	Dibenzofuran (ug/kg)	23	4	17.4	8.8 T	45 J	22.7	16 T	21	8.8 T	6600 U	591	19.5 U	1650 U
surface	Hexachlorobenzene (ug/kg)	23	3	13	1.2 T	5.44 P	3.28	3.2 P	3.2 P	0.19 UT	6600 U	582	19 U	1650 U
surface	Hexachlorobutadiene (ug/kg)	23	0	0						0.19 UT	200 U	42.5	19 U	200 U
surface	Hexachlorocyclopentadiene (ug/kg)	23	0	0						21.5 U	20000 U	1800	95 U	5000 U
surface	Hexachloroethane (ug/kg)	23	0	0						2.29 U	20000 U	1750	19 U	5000 U
surface	Isophorone (ug/kg)	23	0	0						19 U	6600 U	594	22.3 U	1650 U
surface	Nitrobenzene (ug/kg)	23	0	0						19 U	6600 U	593	21.9 UJ	1650 U
surface	N-Nitrosodimethylamine (ug/kg)	11	0	0						16.8 U	300 U	51.9	19.4 U	98 U
surface	N-Nitrosodipropylamine (ug/kg)	23	0	0						16.8 U	6600 U	602	38 U	1650 U
surface	N-Nitrosodiphenylamine (ug/kg)	23	0	0						12.2 U	6600 U	590	19 U	1650 U
surface	Bis(2-chloroisopropyl) ether (ug/kg)	13	0	0						39.7 U	6600 U	1050	47.1 U	3300 U
surface	1,1,1,2-Tetrachloroethane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	1,1,1-Trichloroethane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	1,1,2,2-Tetrachloroethane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	1,1,2-Trichloroethane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	1,1-Dichloroethane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Vinylidene chloride (ug/kg)	5	0	0						0.18 UJT	100 U	80	100 U	100 U
surface	1,2,3-Trichloropropane (ug/kg)	5	0	0						4 UJ	100 U	80.8	100 U	100 U
surface	1,2-Dichloroethane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	1,2-Dichloropropane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Methylethyl ketone (ug/kg)	5	0	0						10 UJ	1000 U	802	1000 U	1000 U
surface	2-Chloroethyl vinyl ether (ug/kg)	1	0	0						10 UJ	10 UJ	10	10 UJ	10 UJ
surface	Methyl N-butyl ketone (ug/kg)	5	0	0						10 UJ	1000 U	802	1000 U	1000 U
surface	Methyl isobutyl ketone (ug/kg)	5	0	0						10 UJ	500 U	402	500 U	500 U
surface	Acetone (ug/kg)	5	1	20	13 J	13 J	13	13 J	13 J	13 J	2500 U	2000	2500 U	2500 U
surface	Acrolein (ug/kg)	1	0	0						100 UJ	100 UJ	100	100 UJ	100 UJ
surface	Acrylonitrile (ug/kg)	1	0	0						10 UJ	10 UJ	10	10 UJ	10 UJ

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Benzene (ug/kg)	5	0	0						0.18 UJT	100 U	80	100 U	100 U
surface	Bromochloromethane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Bromodichloromethane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Bromoethane (ug/kg)	1	0	0						4 UJ	4 UJ	4	4 UJ	4 UJ
surface	Bromoform (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Bromomethane (ug/kg)	5	0	0						2 UJ	500 U	400	500 U	500 U
surface	Carbon disulfide (ug/kg)	5	0	0						2 UJ	1000 U	800	1000 U	1000 U
surface	Carbon tetrachloride (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Chlorodibromomethane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Chloroethane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Chloroform (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Chloromethane (ug/kg)	5	0	0						2 UJ	500 U	400	500 U	500 U
surface	cis-1,3-Dichloropropene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Methylene bromide (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Dichlorodifluoromethane (ug/kg)	5	0	0						2 UJ	500 U	400	500 U	500 U
surface	Ethylbenzene (ug/kg)	5	0	0						0.18 UJT	100 U	80	100 U	100 U
surface	Methyl iodide (ug/kg)	1	0	0						2 UJ	2 UJ	2	2 UJ	2 UJ
surface	Isopropylbenzene (ug/kg)	5	0	0						2 UJ	200 U	160	200 U	200 U
surface	m,p-Xylene (ug/kg)	5	0	0						0.37 UJT	200 U	160	200 U	200 U
surface	Methylene chloride (ug/kg)	5	0	0						4 UJ	500 U	401	500 U	500 U
surface	Methyl tert-butyl ether (ug/kg)	5	0	0						0.18 UJ	100 U	80	100 U	100 U
surface	o-Xylene (ug/kg)	5	0	0						0.18 UJT	100 U	80	100 U	100 U
surface	Styrene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Tetrachloroethene (ug/kg)	5	0	0						0.18 UJT	100 U	80	100 U	100 U
surface	Toluene (ug/kg)	5	0	0						0.18 UJT	100 U	80	100 U	100 U
surface	trans-1,2-Dichloroethene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	trans-1,3-Dichloropropene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Trichloroethene (ug/kg)	5	0	0						0.18 UJT	100 U	80	100 U	100 U
surface	1,4-Dichloro-trans-2-butene (ug/kg)	1	0	0						10 UJ	10 UJ	10	10 UJ	10 UJ
surface	Trichlorofluoromethane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Vinyl chloride (ug/kg)	5	0	0						0.18 UJT	100 U	80	100 U	100 U
surface	Vinyl acetate (ug/kg)	1	0	0						10 UJ	10 UJ	10	10 UJ	10 UJ
surface	1,1-Dichloropropene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	1,1,2-Trichloro-1,2,2-trifluoroethane (ug/kg)	1	0	0						2 UJ	2 UJ	2	2 UJ	2 UJ
surface	1,2-Dibromo-3-chloropropane (ug/kg)	5	0	0						10 UJ	500 U	402	500 U	500 U
surface	1,3,5-Trimethylbenzene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	1,3-Dichloropropane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	2,2-Dichloropropane (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	2-Chlorotoluene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	4-Chlorotoluene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Bromobenzene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	cis-1,2-Dichloroethene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Ethylene dibromide (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	n-Butylbenzene (ug/kg)	5	0	0						4 UJ	500 U	401	500 U	500 U
surface	n-Propylbenzene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	p-Cymene (ug/kg)	5	0	0						2 UJ	200 U	160	200 U	200 U
surface	Pseudocumene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Sec-butylbenzene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	tert-Butylbenzene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	Chlorobenzene (ug/kg)	5	0	0						2 UJ	100 U	80.4	100 U	100 U
surface	1,2,3-Trichlorobenzene (ug/kg)	5	0	0						10 UJ	100 U	82	100 U	100 U
subsurface	Aroclor 1016 (ug/kg)	11	0	0						10 U	80 UG	28	17 U	80 UG
subsurface	Aroclor 1242 (ug/kg)	11	0	0						10 U	80 UG	28	17 U	80 UG
subsurface	Aroclor 1248 (ug/kg)	11	0	0						10 U	80 UG	28	17 U	80 UG
subsurface	Aroclor 1254 (ug/kg)	11	1	9.09	70	70	70	70	70	10 U	80 UG	32.6	17 U	80 UG
subsurface	Aroclor 1260 (ug/kg)	11	2	18.2	9	31	20	9	9	9	80 UG	29	17 U	80 UG
subsurface	Aroclor 1221 (ug/kg)	9	0	0						10 U	39 U	31.9	34 U	39 U
subsurface	Aroclor 1232 (ug/kg)	9	0	0						10 U	20 U	16.4	17 U	19 U
subsurface	Polychlorinated biphenyls (ug/kg)	11	2	18.2	9 A	101 A	55	9 A	9 A	9 A	101 A	46.2	35 UA	80 UA
subsurface	Butyltin ion (ug/l)	1	0	0						0.02 U	0.02 U	0.02	0.02 U	0.02 U
subsurface	Butyltin ion (ug/kg)	2	0	0						5.8 U	270 U	138	5.8 U	5.8 U
subsurface	Dibutyltin ion (ug/l)	1	1	100	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
subsurface	Dibutyltin ion (ug/kg)	2	0	0						5.8 U	270 U	138	5.8 U	5.8 U
subsurface	Tributyltin ion (ug/l)	1	1	100	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
subsurface	Tributyltin ion (ug/kg)	2	1	50	28	28	28	28	28	28	270 U	149	28	28
subsurface	Tetrabutyltin (ug/l)	1	1	100	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
subsurface	Tetrabutyltin (ug/kg)	2	0	0						5.8 U	270 U	138	5.8 U	5.8 U
subsurface	Total solids (percent)	6	6	100	53	77.3	60.1	56.3	61.2	53	77.3	60.1	56.3	61.2
subsurface	Total organic carbon (percent)	15	15	100	1.2	5.6	2.04	1.76	2.4	1.2	5.6	2.04	1.76	2.4
subsurface	Acid Volatile Sulfides (mg/kg)	1	1	100	11.8 G	11.8 G	11.8	11.8 G	11.8 G	11.8 G	11.8 G	11.8	11.8 G	11.8 G
subsurface	Total volatile solids (percent)	12	12	100	4.79	8.84	6.66	6.75	7.86	4.79	8.84	6.66	6.75	7.86
subsurface	Bromine (ug/kg)	2	2	100	5.2	10	7.6	5.2	5.2	5.2	10	7.6	5.2	5.2
subsurface	Chlorine (ug/kg)	2	2	100	161	424	293	161	161	161	424	293	161	161
subsurface	2,3,7,8-Tetrachlorodibenzo-p-dioxin (ng/kg)	3	0	0						0.76 U	8.7 U	3.62	1.4 U	1.4 U
subsurface	Tetrachlorodibenzo-p-dioxin (ng/kg)	2	1	50	7.2	7.2	7.2	7.2	7.2	7.2	8.7 U	7.95	7.2	7.2
subsurface	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (ng/kg)	3	1	33.3	0.92	0.92	0.92	0.92	0.92	0.92	20 U	7.44	1.4 U	1.4 U
subsurface	Pentachlorodibenzo-p-dioxin (ng/kg)	2	1	50	0.92	0.92	0.92	0.92	0.92	0.92	20 U	10.5	0.92	0.92
subsurface	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (ng/kg)	3	1	33.3	3.6	3.6	3.6	3.6	3.6	2 U	16 U	7.2	3.6	3.6
subsurface	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (ng/kg)	3	2	66.7	11	15 B	13	11	11	11	21 U	15.7	15 B	15 B
subsurface	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (ng/kg)	3	2	66.7	5.2	7.5 J	6.35	5.2	5.2	5.2	7.6 U	6.77	7.5 J	7.5 J
subsurface	Hexachlorodibenzo-p-dioxin (ng/kg)	2	2	100	78	200	139	78	78	78	200	139	78	78
subsurface	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (ng/kg)	3	3	100	180	440	280	220 B	220 B	180	440	280	220 B	220 B
subsurface	Heptachlorodibenzo-p-dioxin (ng/kg)	2	2	100	220	1700	960	220	220	220	1700	960	220	220
subsurface	Octachlorodibenzo-p-dioxin (ng/kg)	3	3	100	1700	5400	3030	2000 B	2000 B	1700	5400	3030	2000 B	2000 B
subsurface	2,3,7,8-Tetrachlorodibenzofuran (ng/kg)	3	3	100	1.5	4.4	3.03	3.2 B	3.2 B	1.5	4.4	3.03	3.2 B	3.2 B
subsurface	Tetrachlorodibenzofuran (ng/kg)	2	2	100	4.4	7.5	5.95	4.4	4.4	4.4	7.5	5.95	4.4	4.4
subsurface	1,2,3,7,8-Pentachlorodibenzofuran (ng/kg)	3	0	0						0.51 U	6.9 U	2.87	1.2 U	1.2 U
subsurface	2,3,4,7,8-Pentachlorodibenzofuran (ng/kg)	3	0	0						1.8 U	6.3 U	3.33	1.9 U	1.9 U
subsurface	Pentachlorodibenzofuran (ng/kg)	2	1	50	22	22	22	22	22	6.9 U	22	14.5	6.9 U	6.9 U
subsurface	1,2,3,4,7,8-Hexachlorodibenzofuran (ng/kg)	3	2	66.7	4	14	9	4	4	3.5 U	14	7.17	4	4
subsurface	1,2,3,6,7,8-Hexachlorodibenzofuran (ng/kg)	3	0	0						2.4 U	10 U	6.33	6.6 U	6.6 U
subsurface	1,2,3,7,8,9-Hexachlorodibenzofuran (ng/kg)	3	0	0						0.17 U	18 U	6.46	1.2 U	1.2 U
subsurface	2,3,4,6,7,8-Hexachlorodibenzofuran (ng/kg)	3	0	0						0.95 U	24 U	8.82	1.5 U	1.5 U
subsurface	Hexachlorodibenzofuran (ng/kg)	2	2	100	51	78	64.5	51	51	51	78	64.5	51	51
subsurface	1,2,3,4,6,7,8-Heptachlorodibenzofuran (ng/kg)	3	3	100	26	36	31.7	33 B	33 B	26	36	31.7	33 B	33 B
subsurface	1,2,3,4,7,8,9-Heptachlorodibenzofuran (ng/kg)	3	0	0						3.4 U	6.6 U	4.63	3.9 U	3.9 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
subsurface	Heptachlorodibenzofuran (ng/kg)	2	2	100	26	140	83	26	26	26	140	83	26	26
subsurface	Octachlorodibenzofuran (ng/kg)	3	3	100	79	130	101	94 B	94 B	79	130	101	94 B	94 B
subsurface	Gravel (percent)	8	7	87.5	0.13	2.9	1.13	0.8	2	0.1 U	2.9	0.998	0.4	2
subsurface	Sand (percent)	13	13	100	12.8	43.7	31.8	31.9	43.6	12.8	43.7	31.8	31.9	43.6
subsurface	Fines (percent)	14	14	100	44	87.2	65.9	66.1	78.6	44	87.2	65.9	66.1	78.6
subsurface	Silt (percent)	14	14	100	38.5	69.6	55.8	55.9	65.2	38.5	69.6	55.8	55.9	65.2
subsurface	Clay (percent)	14	14	100	3	17.6	10.1	7.8	16.33	3	17.6	10.1	7.8	16.33
subsurface	Mean grain size (mm)	12	12	100	0.025	0.269	0.107	0.066	0.221	0.025	0.269	0.107	0.066	0.221
subsurface	Median grain size (mm)	12	12	100	0.023	0.09	0.0441	0.043	0.057	0.023	0.09	0.0441	0.043	0.057
subsurface	Dalapon (ug/kg)	7	0	0						69 U	94 U	84	86 U	87 U
subsurface	Dicamba (ug/kg)	7	0	0						27 U	38 U	33.7	34 U	35 U
subsurface	MCPA (ug/kg)	7	0	0						14 U	19 U	16.7	17 U	17 U
subsurface	Dichloroprop (ug/kg)	7	0	0						14 U	19 U	16.7	17 U	17 U
subsurface	2,4-D (ug/kg)	7	0	0						14 U	19 U	16.7	17 U	17 U
subsurface	Silvex (ug/kg)	7	0	0						14 U	19 U	16.7	17 U	17 U
subsurface	2,4,5-T (ug/kg)	7	0	0						14 U	19 U	16.7	17 U	17 U
subsurface	2,4-DB (ug/kg)	7	0	0						14 U	19 U	16.7	17 U	17 U
subsurface	Dinoseb (ug/kg)	7	0	0						14 U	19 U	16.7	17 U	17 U
subsurface	MCPP (ug/kg)	7	0	0						14 U	19 U	16.7	17 U	17 U
subsurface	Aluminum (mg/kg)	2	2	100	31900	45900	38900	31900	31900	31900	45900	38900	31900	31900
subsurface	Antimony (mg/kg)	9	0	0						5 UJ	140 U	98.9	120 U	130 U
subsurface	Arsenic (mg/kg)	12	11	91.7	0.6 E	9	3.73	3.6	4.4 G	0.6 E	9	3.83	3.6	5 U
subsurface	Cadmium (mg/kg)	12	5	41.7	0.18	5.3	1.32	0.32 G	0.5	0.18	5.3	1.47	1.5 U	1.8 U
subsurface	Chromium (mg/kg)	5	5	100	22 G	157	54.5	26.9	40.7	22 G	157	54.5	26.9	40.7
subsurface	Copper (mg/kg)	12	12	100	26.8	124	46	37	52.6	26.8	124	46	37	52.6
subsurface	Lead (mg/kg)	12	5	41.7	19.2 G	1080	235	25	26	19.2 G	1080	127	41 U	72 U
subsurface	Manganese (mg/kg)	4	4	100	483	904 G	695	634 G	759	483	904 G	695	634 G	759
subsurface	Mercury (mg/kg)	12	10	83.3	0.06	0.37	0.163	0.11	0.3	0.06	0.37	0.162	0.12	0.3
subsurface	Nickel (mg/kg)	12	12	100	20	39 G	26	21.7	39 G	20	39 G	26	21.7	39 G
subsurface	Selenium (mg/kg)	2	2	100	7	8	7.5	7	7	7	8	7.5	7	7
subsurface	Silver (mg/kg)	10	6	60	0.068 J	3.4	0.836	0.21 E	1	0.068 J	3.4	0.817	0.71 U	1
subsurface	Thallium (mg/kg)	2	0	0						5 U	5 U	5	5 U	5 U
subsurface	Zinc (mg/kg)	12	12	100	80.6	583	153	110	170	80.6	583	153	110	170
subsurface	Barium (mg/kg)	2	2	100	199	274	237	199	199	199	274	237	199	199
subsurface	Beryllium (mg/kg)	2	2	100	0.44	0.65	0.545	0.44	0.44	0.44	0.65	0.545	0.44	0.44
subsurface	Calcium (mg/kg)	2	2	100	6420	8700	7560	6420	6420	6420	8700	7560	6420	6420
subsurface	Cobalt (mg/kg)	2	2	100	17.6	20.1	18.9	17.6	17.6	17.6	20.1	18.9	17.6	17.6
subsurface	Iron (mg/kg)	4	4	100	32900 G	44600	37100	34400 G	36500	32900 G	44600	37100	34400 G	36500
subsurface	Magnesium (mg/kg)	2	2	100	5750	7720	6740	5750	5750	5750	7720	6740	5750	5750
subsurface	Potassium (mg/kg)	2	2	100	1210	1470	1340	1210	1210	1210	1470	1340	1210	1210
subsurface	Sodium (mg/kg)	2	2	100	714 J	1120 J	917	714 J	714 J	714 J	1120 J	917	714 J	714 J
subsurface	Titanium (mg/kg)	2	2	100	1870	1990	1930	1870	1870	1870	1990	1930	1870	1870
subsurface	Vanadium (mg/kg)	2	2	100	91.9	108	100	91.9	91.9	91.9	108	100	91.9	91.9
subsurface	2-Methylnaphthalene (ug/kg)	10	2	20	8 G	2000	1000	8 G	8 G	2.3 U	2000	205	2.9 U	19 U
subsurface	Acenaphthene (ug/kg)	12	3	25	3.1	21	9.7	5 G	5 G	2.3 U	910 U	105	3.1	150 UG
subsurface	Acenaphthylene (ug/kg)	12	4	33.3	4.3	6.7	5.48	5 G	5.9	2.9 U	910 U	105	5 G	150 UG
subsurface	Anthracene (ug/kg)	12	6	50	3	9 G	5.05	3.5	7.8	2.9 U	910 U	164	3.6	500 UG
subsurface	Fluorene (ug/kg)	12	3	25	3.9	22	11	7 G	7 G	2.3 U	910 U	113	3.2 U	200 UG

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
subsurface	Naphthalene (ug/kg)	12	6	50	3.7	30	12	6.3	16 G	2.8 U	910 U	99.2	6.3	100 UG
subsurface	Phenanthrene (ug/kg)	12	9	75	7.3	1100	147	13	99	3.2 U	1100	177	13	400 UG
subsurface	Low Molecular Weight PAH (ug/kg)	12	9	75	7.3 A	1100 A	168	24.6 A	172 A	3.2 UA	1100 A	210	24.6 A	500 UA
subsurface	Dibenz(a,h)anthracene (ug/kg)	12	1	8.33	4 G	4 G	4	4 G	4 G	2.3 U	910 U	188	3 U	650 UG
subsurface	Benz(a)anthracene (ug/kg)	12	8	66.7	4.7	38	14.7	9.4	21 G	3.2 U	910 U	169	11	500 UG
subsurface	Benzo(a)pyrene (ug/kg)	12	7	58.3	4.7	38	15.5	13	22 G	2.8 U	910 U	202	13	700 UG
subsurface	Benzo(b)fluoranthene (ug/kg)	10	8	80	5.3	58	18.4	13	25	3.2 U	910 U	106	13	58
subsurface	Benzo(g,h,i)perylene (ug/kg)	12	5	41.7	6.3	32	15.1	13	17 G	2.8 U	1400 UG	316	7.2	1400 UG
subsurface	Benzo(k)fluoranthene (ug/kg)	10	6	60	3.3	36	13	7.6	18 G	2.8 U	910 U	99.7	4.8	36
subsurface	Chrysene (ug/kg)	12	8	66.7	6.9	64	20.2	12	28 G	3.2 U	910 U	173	13	500 UG
subsurface	Fluoranthene (ug/kg)	12	9	75	3.8	130	35.4	19	57 G	3.8	910 U	236	26	800 UG
subsurface	Indeno(1,2,3-cd)pyrene (ug/kg)	12	5	41.7	5.5	24 J	13.5	14	17 G	2.3 U	910 U	191	7.2	650 UG
subsurface	Pyrene (ug/kg)	12	9	75	5.1	150	37.7	18	53 G	5.1	910 U	254	23	900 UG
subsurface	Benzo(b+k)fluoranthene (ug/kg)	12	9	75	7.9 A	1400 G	181	17.8 A	94 A	3.2 UA	1400 G	287	17.8 A	910 UA
subsurface	High Molecular Weight PAH (ug/kg)	12	10	83.3	8.9 A	1400 A	282	89.2 A	570 A	8.9 A	1400 UA	427	92.7 A	1400 A
subsurface	Polycyclic Aromatic Hydrocarbons (ug/kg)	12	11	91.7	8.9 A	1400 A	394	112.2 A	1100 A	8.9 A	1400 UA	478	112.2 A	1400 A
subsurface	4,4'-DDD (ug/kg)	11	3	27.3	0.8	4 G	2.63	3.1	3.1	0.8	8 UG	3.67	3.5 U	4 G
subsurface	4,4'-DDT (ug/kg)	11	1	9.09	0.5	0.5	0.5	0.5	0.5	0.5	16 UG	5.23	3.5 U	10 UG
subsurface	4,4'-DDE (ug/kg)	11	3	27.3	1	5.9	3.63	4	4	1	8 UG	4.25	3.5 U	8 UG
subsurface	Total of 3 isomers: pp-DDT,-DDD,-DDE (ug/kg)	11	4	36.4	2.3 A	7.1 A	4.83	4 A	5.9 A	2.3 A	10 UA	4.92	3.9 UA	7.2 UA
subsurface	Aldrin (ug/kg)	11	0	0						0.97 U	4 UG	2.08	1.7 U	4 UG
subsurface	alpha-Hexachlorocyclohexane (ug/kg)	11	0	0						0.97 U	4 UG	2.08	1.7 U	4 UG
subsurface	beta-Hexachlorocyclohexane (ug/kg)	11	0	0						0.97 U	4 UG	2.08	1.7 U	4 UG
subsurface	delta-Hexachlorocyclohexane (ug/kg)	11	0	0						0.97 UJ	4 UG	2.08	1.7 U	4 UG
subsurface	gamma-Hexachlorocyclohexane (ug/kg)	11	0	0						0.97 U	4 UG	2.08	1.7 U	4 UG
subsurface	cis-Chlordane (ug/kg)	1	0	0						0.97 UJ	0.97 UJ	0.97	0.97 UJ	0.97 UJ
subsurface	Dieldrin (ug/kg)	11	0	0						1.9 U	8 UG	3.97	3.4 U	8 UG
subsurface	alpha-Endosulfan (ug/kg)	11	0	0						0.97 U	12 UG	3.53	1.7 U	12 UG
subsurface	beta-Endosulfan (ug/kg)	11	0	0						1.9 U	8 UG	3.97	3.4 U	8 UG
subsurface	Endosulfan sulfate (ug/kg)	11	0	0						1.9 UJ	8 UG	3.97	3.4 U	8 UG
subsurface	Endrin (ug/kg)	11	0	0						1.9 U	8 UG	3.97	3.4 U	8 UG
subsurface	Endrin aldehyde (ug/kg)	9	0	0						1.9 U	3.9 U	3.08	3.4 U	3.5 U
subsurface	Endrin ketone (ug/kg)	10	0	0						2.2 UJ	8 UG	4.2	3.4 U	8 UG
subsurface	Heptachlor (ug/kg)	11	0	0						0.97 U	4 UG	2.08	1.7 U	4 UG
subsurface	Heptachlor epoxide (ug/kg)	11	0	0						0.97 U	4 UG	2.08	1.7 U	4 UG
subsurface	Methoxychlor (ug/kg)	11	0	0						4 U	20 U	15	17 U	17 U
subsurface	Toxaphene (ug/kg)	11	0	0						30 U	400 UG	192	170 U	400 UG
subsurface	gamma-Chlordane (ug/kg)	1	0	0						0.97 U	0.97 U	0.97	0.97 U	0.97 U
subsurface	Chlordane (cis & trans) (ug/kg)	10	0	0						10 U	40 UG	20.9	17 U	40 UG
subsurface	2,4,5-Trichlorophenol (ug/kg)	9	0	0						12 U	4500 U	522	15 U	97 U
subsurface	2,4,6-Trichlorophenol (ug/kg)	10	0	0						12 U	4500 U	490	15 U	200 UG
subsurface	2,4-Dichlorophenol (ug/kg)	10	0	0						12 U	2700 U	306	15 U	200 UG
subsurface	2,4-Dimethylphenol (ug/kg)	10	0	0						12 U	910 U	113	15 U	100 UG
subsurface	2,4-Dinitrophenol (ug/kg)	10	1	10	17000 G	17000 G	17000	17000 G	17000 G	12 U	17000 G	2640	15 U	9100 UJ
subsurface	2-Chlorophenol (ug/kg)	10	0	0						12 U	910 U	110	15 U	70 UG
subsurface	2-Methylphenol (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	2-Nitrophenol (ug/kg)	9	0	0						12 U	4500 U	522	15 U	97 U
subsurface	4,6-Dinitro-2-methylphenol (ug/kg)	10	1	10	3600 G	3600 G	3600	3600 G	3600 G	12 U	9100 UJ	1300	15 U	3600 G

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
subsurface	4-Chloro-3-methylphenol (ug/kg)	10	0	0						12 U	1800 U	202	15 U	80 UG
subsurface	4-Methylphenol (ug/kg)	2	1	50	46	46	46	46	46	46	910 U	478	46	46
subsurface	4-Nitrophenol (ug/kg)	10	0	0						12 U	4500 U	510	15 U	400 UG
subsurface	Pentachlorophenol (ug/kg)	10	8	80	9.4 J	700 G	105	16	47	9.4 J	4500 U	544	16	700 G
subsurface	Phenol (ug/kg)	10	3	30	5.1 J	700 G	238	8.4 J	8.4 J	5.1 J	910 U	171	14 U	700 G
subsurface	3- and 4-Methylphenol Coelution (ug/kg)	7	7	100	4.8 J	300	63.7	29	48	4.8 J	300	63.7	29	48
subsurface	Dimethyl phthalate (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	Diethyl phthalate (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	Dibutyl phthalate (ug/kg)	9	7	77.8	4.4 JB	7.6 JB	5.41	5 JB	6 JB	4.4 JB	910 U	107	5.3 JB	19 U
subsurface	Butylbenzyl phthalate (ug/kg)	9	5	55.6	3.8 J	47	16.3	7.8 J	19	3.8 J	910 U	115	14 U	47
subsurface	Di-n-octyl phthalate (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	Bis(2-ethylhexyl) phthalate (ug/kg)	9	9	100	11 JB	5000	608	40 B	210	11 JB	5000	608	40 B	210
subsurface	1,2,4-Trichlorobenzene (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	1,2-Dichlorobenzene (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	1,3-Dichlorobenzene (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	1,4-Dichlorobenzene (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	Bis(2-chloro-1-methylethyl) ether (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	2,4-Dinitrotoluene (ug/kg)	9	0	0						12 U	4500 U	522	15 U	97 U
subsurface	2,6-Dinitrotoluene (ug/kg)	9	0	0						12 U	4500 U	522	15 U	97 U
subsurface	2-Chloronaphthalene (ug/kg)	9	0	0						2.8 U	910 U	106	3 U	19 U
subsurface	2-Nitroaniline (ug/kg)	9	0	0						12 U	4500 U	522	15 U	97 U
subsurface	3,3'-Dichlorobenzidine (ug/kg)	9	0	0						12 U	4500 U	522	15 U	97 U
subsurface	3-Nitroaniline (ug/kg)	9	0	0						12 U	5500 U	636	15 U	120 U
subsurface	4-Bromophenyl phenyl ether (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	4-Chloroaniline (ug/kg)	9	0	0						12 U	2700 U	318	15 U	58 U
subsurface	4-Chlorophenyl phenyl ether (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	4-Nitroaniline (ug/kg)	9	0	0						12 U	4500 UJ	522	15 U	97 UJ
subsurface	Benzoic acid (ug/kg)	9	3	33.3	8.7 J	380	133	9.7 J	9.7 J	8.7 J	9100 U	1060	14 U	380
subsurface	Benzyl alcohol (ug/kg)	9	3	33.3	5.7 J	9 J	7.33	7.3 J	7.3 J	5.7 J	910 U	112	14 U	19 U
subsurface	Bis(2-chloroethoxy) methane (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	Bis(2-chloroethyl) ether (ug/kg)	9	0	0						12 U	1800 U	215	15 U	39 U
subsurface	Carbazole (ug/kg)	2	0	0						19 U	910 UJ	465	19 U	19 U
subsurface	Dibenzofuran (ug/kg)	10	1	10	7 G	7 G	7	7 G	7 G	7 G	910 U	104	14 U	19 U
subsurface	Hexachlorobenzene (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	Hexachlorobutadiene (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	Hexachlorocyclopentadiene (ug/kg)	9	0	0						12 U	4500 U	522	15 U	97 UJ
subsurface	Hexachloroethane (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	Isophorone (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	Nitrobenzene (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U
subsurface	N-Nitrosodipropylamine (ug/kg)	9	0	0						12 U	1800 U	215	15 U	39 U
subsurface	N-Nitrosodiphenylamine (ug/kg)	9	0	0						12 U	910 U	114	15 U	19 U

SUPPLEMENTAL TABLES

DO NOT QUOTE OR CITE.
This Document is currently under review by US EPA and its federal, state and tribal partners,
and is subject to change is whole or part.

Table 1. Gunderson Site Outfall Nomenclature Key.

LWG NAME	GUNDERSON NAME	CITY OF PORTLAND NAME
WR-127	OF-1	
WR-128	OF-2	
WR-129	OF-3	
WR-360	OF-3A	
WR-130	OF-4	
WR-131	OF-5	
WR-132	OF-6	
WR-133	OF-7	
WR-361	OF-7A	
WR-134	OF-8	
WR-135	OF-9	
WR-136	OF-10	
WR-137	OF-11	
	OF-12	OF-18
WR-138	OF-13	
WR-139	OF-14	
WR-140	OF-15	
WR-141	OF-16	
WR-142	OF-17	
WR-363	OF-18A	
WR-143	OF-18	
WR-144	OF-19	
WR-145	OF-20	
WR-150	OF-24	
WR-146	OF-21	
WR-147	OF-22	
WR-148	OF-23	
WR-149	SEEP-01	

	TCA (mg/L)	Total HVOCs (mg/L)	Percent of Total HVOCs that is 1,1,1-Trichloroethane																		
	Apr-04	Apr-04	Sep-98	Dec-98	May-99	Aug-99	Dec-99	Apr-00	Oct-00	Nov-00	Feb-01	May-01	Aug-01	Dec-01	Apr-02	Jul-02	Nov-02	Feb-03	May-03	Nov-03	Apr-04
Shallow monitoring wells, upgradient from source																					
MW-34			100%	0%	0%	0%	0%	0%	0%					0%			0%			0%	
MW-22			0%	0%	0%	0%	0%	0%	0%					0%			0%			0%	
Deep monitoring wells, upgradient from source																					
MW-41			83%	84%	89%	89%	75%	86%	93%			80%		85%			85%			68%	
MW-42			100%	100%	0%	0%	0%	0%	0%					0%			0%			0%	
Shallow monitoring wells, near source																					
MW-45	3.88	4.83			89%	85%	82%	87%	89%		91%	87%	86%	81%	85%	83%	84%	85%	83%	84%	80%
MW-21	0.060	0.151	12%	72%	57%	34%	67%	71%	8%			1%		54%			6%		45%	4%	40%
Deep monitoring wells, near source																					
MW-27	0.026	0.077	51%	38%	47%	31%	33%	44%	54%			31%		34%			32%		29%	24%	34%
MW-36	0.008	1.340	74%	62%	79%	71%	62%	63%	75%		66%	52%	54%	58%	49%	46%	52%		93%	69%	1%
Shallow monitoring wells, downgradient from source																					
MW-19			81%	0%	29%	18%	0%	0%	0%					0%			0%			0%	
MW-20			0%	0%		0%	0%	0%	0%					0%			0%			0%	
MW-37	0.000	0.001	0%	41%	0%	0%	0%	0%	0%		0%			0%	0%		0%			0%	0%
MW-49	0.467	1.048								56%	63%	63%	59%	54%	60%	60%	56%		52%	50%	45%
MW-50										31%	78%	85%	91%	84%	52%	73%	74%		59%	79%	
MW-51	0.002	0.004								72%	75%	76%	69%	61%	58%	62%	55%		39%	45%	48%
Deep monitoring wells, down gradient from source																					
MW-38	0.009	0.037	69%	59%	77%	73%	61%	73%	69%		71%	64%	64%	54%	57%		46%		39%	27%	25%
MW-39			62%	72%	78%	57%	72%	72%	83%			47%		17%			57%			65%	
MW-40			90%	100%	84%	100%	73%	0%	75%					0%			6%			0%	
MW-43	0.005	0.012			100%	100%	70%	60%	79%		70%	47%	41%	27%	22%	57%	59%		75%	63%	41%
MW-44	0.078	0.158			54%	84%	72%	57%	0%		74%	0%	0%	0%	0%		59%		54%	49%	49%
MW-52	0.086	0.274								37%	43%	36%	33%	30%	34%	33%	32%			27%	31%
MW-53										0%	0%	0%	0%	100%	0%		0%			0%	
MW-62	0.278	0.657												47%	54%	52%	45%	50%	44%	40%	42%
WEX-60	0.25	0.907												52%	53%	57%	51%	52%	43%	37%	28%

	Degradation Compounds (mg/L)	Total HVOCs (mg/L)	Percent ot Total HVOCs that are Degradation Compounds																		
	Apr-04	Apr-04	Sep-98	Dec-98	May-99	Aug-99	Dec-99	Apr-00	Oct-00	Nov-00	Feb-01	May-01	Aug-01	Dec-01	Apr-02	Jul-02	Nov-02	Feb-03	May-03	Nov-03	Apr-04
Shallow monitoring wells, upgradient from source																					
MW-34	[redacted]	[redacted]	0%	0%	0%	0%	0%	0%	0%	[redacted]	[redacted]	[redacted]	[redacted]	0%	[redacted]	[redacted]	0%	[redacted]	[redacted]	0%	[redacted]
MW-22	[redacted]	[redacted]	0%	0%	0%	0%	0%	0%	0%	[redacted]	[redacted]	[redacted]	[redacted]	100%	[redacted]	[redacted]	100%	[redacted]	[redacted]	100%	[redacted]
Deep monitoring wells, upgradient from source																					
MW-41	[redacted]	[redacted]	12%	16%	11%	11%	19%	8%	8%	[redacted]	[redacted]	20%	[redacted]	15%	[redacted]	[redacted]	15%	[redacted]	[redacted]	29%	[redacted]
MW-42	[redacted]	[redacted]	0%	0%	0%	0%	0%	0%	0%	[redacted]	[redacted]	[redacted]	[redacted]	0%	[redacted]	[redacted]	0%	[redacted]	[redacted]	0%	[redacted]
Shallow monitoring wells, near source																					
MW-45	0.947	4.83	[redacted]	[redacted]	11%	15%	18%	13%	11%	[redacted]	13%	13%	14%	19%	15%	17%	16%	14%	16%	16%	20%
MW-21	0.077	0.151	63%	26%	41%	58%	32%	27%	69%	[redacted]	[redacted]	65%	[redacted]	45%	[redacted]	[redacted]	79%	[redacted]	53%	74%	51%
Deep monitoring wells, near source																					
MW-27	0.045	0.077	44%	59%	43%	66%	63%	51%	40%	[redacted]	[redacted]	64%	[redacted]	59%	[redacted]	[redacted]	61%	[redacted]	62%	66%	58%
MW-36	0.623	1.574	26%	38%	21%	29%	38%	37%	24%	[redacted]	33%	47%	45%	41%	50%	48%	48%	[redacted]	4%	30%	40%
Shallow monitoring wells, downgradient from source																					
MW-19	[redacted]	[redacted]	7%	100%	58%	82%	0%	68%	75%	[redacted]	[redacted]	[redacted]	[redacted]	69%	[redacted]	[redacted]	0%	[redacted]	[redacted]	0%	[redacted]
MW-20	[redacted]	[redacted]	0%	0%	0%	0%	0%	0%	0%	[redacted]	[redacted]	[redacted]	[redacted]	0%	[redacted]	[redacted]	0%	[redacted]	[redacted]	0%	[redacted]
MW-37	0.001	0.001	100%	31%	100%	100%	0%	0%	0%	[redacted]	0%	[redacted]	[redacted]	0%	0%	[redacted]	100%	[redacted]	[redacted]	0%	90%
MW-49	0.564	1.048	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	42%	36%	36%	39%	43%	39%	39%	43%	[redacted]	47%	49%	54%
MW-50	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	14%	18%	15%	9%	16%	51%	27%	26%	[redacted]	40%	31%	[redacted]
MW-51	0.002	0.004	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	28%	24%	24%	30%	38%	41%	37%	45%	[redacted]	60%	54%	40%
Deep monitoring wells, down gradient from source																					
MW-38	0.026	0.037	31%	40%	23%	26%	39%	26%	30%	[redacted]	28%	35%	35%	45%	42%	[redacted]	53%	[redacted]	60%	72%	71%
MW-39	[redacted]	[redacted]	36%	26%	21%	42%	28%	28%	17%	[redacted]	[redacted]	53%	[redacted]	82%	[redacted]	[redacted]	42%	[redacted]	[redacted]	33%	[redacted]
MW-40	[redacted]	[redacted]	8%	0%	0%	0%	27%	0%	25%	[redacted]	[redacted]	[redacted]	[redacted]	100%	[redacted]	[redacted]	94%	[redacted]	[redacted]	0%	[redacted]
MW-43	0.006	0.012	[redacted]	[redacted]	0%	0%	29%	30%	20%	[redacted]	30%	48%	58%	73%	79%	43%	41%	[redacted]	0%	38%	52%
MW-44	0.078	0.158	[redacted]	[redacted]	46%	16%	28%	41%	0%	[redacted]	26%	0%	0%	0%	0%	[redacted]	40%	[redacted]	45%	50%	49%
MW-52	0.176	0.274	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	60%	54%	60%	63%	66%	62%	63%	64%	[redacted]	[redacted]	70%	64%
MW-53	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	0%	0%	0%	0%	0%	0%	[redacted]	0%	[redacted]	[redacted]	0%	[redacted]
MW-62	0.397	0.657	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	51%	44%	47%	52%	49%	54%	56%	60%
WEX-60	0.641	0.907	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	47%	46%	42%	48%	47%	56%	62%	71%

	Other Compounds (mg/L)	Total HVOCs (mg/L)	Percent of Total HVOCs that are Other HVOCs																		
	Apr-04	Apr-04	Sep-98	Dec-98	May-99	Aug-99	Dec-99	Apr-00	Oct-00	Nov-00	Feb-01	May-01	Aug-01	Dec-01	Apr-02	Jul-02	Nov-02	Feb-03	May-03	Nov-03	Apr-04
Shallow monitoring wells, upgradient from source																					
MW-34			0%	0%	0%	0%	0%	0%	0%					0%			0%			0%	
MW-22			0%	0%	0%	0%	0%	0%	0%					0%			0%			0%	
Deep monitoring wells, upgradient from source																					
MW-41			5%	0%	0%	0%	6%	6%	0%			0%		0%			0%			0%	
MW-42			0%	0%	0%	0%	0%	0%	0%					0%			0%			0%	
Shallow monitoring wells, near source																					
MW-45	0.0000	4.83			0%	0%	0%	0%	0%		0%	0%	0.3%	0%	0%	0%	0%	0%	0.4%	0.4%	0%
MW-21	0.0142	0.15	24%	1%	1%	7%	1%	2%	22%			34%		1%			16%		2%	22%	9%
Deep monitoring wells, near source																					
MW-27	0.006	0.077	6%	6%	0%	3%	4%	5%	5%			5%		7%			8%		8%	10%	7%
MW-36	0.008	1.340	0%	1%	0%	0%	0%	0%	1%		0%	1%	1%	1%	1%	1%	1%		0%	0%	1%
Shallow monitoring wells, downgradient from source																					
MW-19			11%	0%	23%	18%	14%	32%	25%					30%			0%			0%	
MW-20			0%	0%	0%	100%	0%	0%	0%					0%			0%			0%	
MW-37	0.000	0.001	0%	28%	0%	0%	0%	0%	0%		100%			0%	0%		0%			0%	0%
MW-49	0.017	1.048								2%	0%	2%	2%	3%	1%	1%	2%		1%	2%	2%
MW-50										55%	4%	0%	0%	0%	0%	0%	0%		0%	0%	
MW-51	0.000	0.004								0%	1%	0%	1%	1%	1%	1%	1%		1%	1%	0%
Deep monitoring wells, down gradient from source																					
MW-38	0.001	0.037	0%	2%	0%	0%	0%	1%	1%		0%	1%	1%	1%	1%		1%		1%	1%	3%
MW-39			1%	2%	1%	1%	1%	0%	0%			1%		1%			1%			2%	
MW-40			2%	0%	0%	0%	0%	0%	0%					0%			0%			0%	
MW-43	0.001	0.012			0%	0%	1%	5%	0%		0%	5%	1%	0%	0%	0%	0%		0%	0%	4%
MW-44	0.002	0.158			0%	0%	0%	1%	0%		0%	0%	0%	0%	0%		1%		1%	1%	1%
MW-52	0.012	0.274								4%	3%	4%	5%	3%	3%	4%	4%			4%	4%
MW-53										0%	0%	0%	0%	0%	0%		0%			0%	
MW-62	0.011	0.657												2%	2%	2%	2%	1%	1%	2%	2%
WEX-60	0.016	0.907												1%	1%	1%	1%	1%	1%	1%	2%

=data not available for the dates
mg/L = milligrams per liter
Total HVOCs = summation of halogenated volatile organic compounds
Degradation Compounds = 1,1-dichloroethane, 1,2-dichloroethane, cis-1,2-dichloroethene, 1,1-dichloroethene, and vinyl chloride
Other HVOCs = tetrachloroethene, trichloroethene, chloroform, and dichloropropane

Appendix A-7

Kinder Morgan Linnton Terminal

KINDER MORGAN LIQUIDS TERMINAL - LINNTON PETROLEUM TERMINAL

Oregon DEQ ECSI #: 1096

11400 NW St. Helens Road
DEQ Site Mgr: Don Pettit
Latitude: 45.6033°
Longitude: -122.787°
Township/Range/Section: 1N/1W/3

River Mile: 4.4 West bank

LWG Member ☒ Yes ☐ No

Upland Analytical Data Status: ☒ Electronic Data Available ☐ Hardcopies only

1. SUMMARY OF POTENTIAL CONTAMINANT TRANSPORT PATHWAYS TO THE RIVER

The current understanding of the transport mechanism of contaminants from the uplands portions of the site to the river is summarized in this section and Table 1 and supported in following sections. The general potential migration pathways include movement of released contaminants through air, soil and groundwater. The potential air pathway results from a potential release where a portion of the material volatilizes into the ambient air and would be dispersed by prevailing winds. The potential soil and groundwater migration pathways would typically result from a potential release where a portion of the released material penetrates into the predominately sandy silt and gravel surface soils and downward through the soil column to the subsurface soil to the groundwater, which has been observed at depths ranging from approximately 9 to 24 feet below grade. If released contaminants reach groundwater, the insoluble components of the released material, such as the separate phase hydrocarbons (SPHs) will generally form a lens on the groundwater surface, whereas the more soluble components will tend to dissolve into the groundwater. Both the SPH and dissolved components have the potential to migrate downgradient (in the direction of groundwater flow) with or on the surface of the groundwater. Based on the *Draft Remedial Investigation* report (KHM Environmental Management, Inc., October 2002) and groundwater monitoring reports, the groundwater flow direction at the Kinder Morgan Linnton Terminal (Site) generally appears to be northeasterly, toward the Willamette River.

1.1. Overland Transport

The ASTs are all located within containment walls and the surface covering within the containment wall is primarily imported sand and gravel that helps reduce potential for erosion. Additionally, access to the area within the AST containment walls is limited and activities that might cause or exacerbate erosion are limited to foot traffic. A majority of areas outside of the AST containment areas are paved with concrete or asphalt. Stormwater that collects within the AST containment area and into site catch basins is directed to one of two large API oil-water separators. Under normal conditions the discharge from the two API oil-water separators is pumped into AST 3034 where it is sampled prior to batch discharge. During larger precipitation events, once AST 3034 is full, storm water is visually inspected at the effluent end of the API oil-water separator and discharged to the Willamette River. Stormwater is discharged from the Site under a 1300 general NPDES stormwater discharge permit. Limited site operations and site controls limit potential pathways for contaminants to reach the Willamette River.

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This document currently under review by US EPA and its federal, state and tribal partners, and is subject to change in whole or part.

1.2. *Riverbank Erosion*

With the one exception of above-grade pipeline connecting the Site dock to the ASTs, no petroleum storage or handling occurs at or near the riverfront outside of the AST containment area. Contaminant transport via river bank erosion is not considered relevant at this site since Site contaminants are limited to petroleum fuels and are not associated with the river bank or river bank area. The entire shoreline of the KMLT Linnton Terminal is lined with a three-tiered timber seawall and associated rip rap covering for protection of the seawall. Thus eliminating riverbank erosion of the terminal's shoreline.

1.3. *Groundwater*

Groundwater is first encountered at the Site at depths ranging from approximately 9 to 24 feet below grade within the sand, silty-sand, and gravelly-silt fill material and alluvium soil encountered below the fill material. The alluvium consists primarily of silty, sandy silt soil with inter-laying of silty-sand soils. Based on the *Draft Remedial Investigation* report (KHM Environmental Management, Inc., October 2002) and the known history of Site activities, the contaminants of potential concern (COPCs) identified in soil and groundwater at the Site are associated with refined petroleum products and can be arranged into three broad groups of chemicals: volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs) and metals. The Draft RI report identified 1,2-dichloroethane, benzene, naphthalene, and n-propylbenzene as groundwater COPCs for the Site.

During January 2002, an apparent hydrocarbon sheen was noticed on the Willamette River along the seawall of the Site. During the completion of the Remedial Investigation (RI), KMLT extensively investigated the upland area near this apparent hydrocarbon seep. SPH has been found in the upland monitoring wells immediately adjacent to the seawall. Two separate pilot test events have been performed using recovery wells to evaluate the appropriate Interim Remedial Action Measures (IRAM), and in July 2004, KMLT completed the installation and start-up of the IRAM Area Containment System that consist of five four-inch diameter groundwater recovery wells RW-1 through RW-5 along the seawall. This IRAM Area Containment System (system) is designed to control groundwater flow in the area of the SPH seep and the recovery of SPH from the five recovery wells and from MW-2 and MW-19. Groundwater control is accomplished by the simultaneous extraction of groundwater from the five recovery wells RW-1 through RW-5. Extracted groundwater is treated with a sand filter followed by activated carbon. Treated groundwater is discharged to the Willamette River under a 1500A General NPDES discharge permit (DEQ permit files number 32300). SPH is recovered from each of the five RW wells and in wells MW-2 and MW-19 using free-product pumps installed in the wells mentioned above.

1.4. *Direct Discharge (Overwater Activities and Stormwater/Wastewater Systems)*

Overwater activities at the Site are limited to the dock on the Willamette River. The dock is infrequently used for loading and unloading of petroleum fuels through above-grade conveyance pipelines connecting the Site dock to the ASTs. No petroleum storage occurs at or near the riverfront outside of the AST containment area.

Stormwater, under normal conditions, discharges from the two API oil-water separators and is pumped into AST 3034 where it is sampled prior to batch discharge. During larger precipitation events, once AST 3034 is full, storm water is visually inspected at the effluent end of the API oil-water separator and discharged to the Willamette River. Storm water is discharge from the Site under a 1300 general NPDES storm water discharge permit. Limited site operations and site controls limit potential pathways for contaminants to reach the Willamette River via stormwater.

Wastewater systems at the Site are limited to the IRAM Area Containment System where the treated groundwater is discharged to the Willamette River under a 1500A General NPDES discharge permit (DEQ permit files number 32300). Process water volumes from Site operations are limited and are typically generated from the separation of water from product in the ASTs. Typically, this water is conveyed with the product to the owners of the product. Prior to the mid-1980s, the process water was treated through the oil-water separator.

1.5. Relationship of Upland Sources to River Sediments

See Final CSM Update.

1.6. Sediment Transport

The Site is located on the west bank of the river just upstream of RM 4. This portion of the river was characterized in the Portland Harbor Work Plan (Integral et al. 2004) as transitional between the upstream transport zone (RM 5-7) and the downstream depositional zone (RM 1-3). The Sediment Trend Analysis® results suggest that the nearshore environment off of Site episodically experiences both net accretion and net erosion and that the mid-channel and eastern side of the river is in dynamic equilibrium. Time-series bathymetric change data over the 25-month period from January 2002 through February 2004 (Integral and DEA in prep) show notable sediment accumulation up to greater than 2ft in extent along the outside of the Site dock structure and out to the –30 ft NAVD88 contour. No time-series bathymetry data were collected inside of the dock structure due to limited boat access. The riverbed in the main channel offshore of the Site shows no measurable riverbed elevation change over measurement period.

2. CSM SITE SUMMARY REVISIONS

Date of Last Revision: September 15, 2004

3. PROJECT STATUS

[Primary Source: ECSI file and DEQ Staff Report]

Activity		Date(s)/Comments
Site Investigation	☐	
PA/XPA	☒	DEQ prepared PA during October 1991
RI	☒	Draft RI submitted October 2002
FS	☐	
Interim Action/Source Control	☒	Interim Remedial Action Measures initiated in July 2004
ROD	☐	
RD/RA	☐	
NFA	☐	

DEQ Portland Harbor Site Ranking (Tier 1, 2, or 3): 1

4. SITE OWNER HISTORY

Owner/Occupant	Type of Operation	Years
Kinder Morgan Liquid Terminals LLC	Refined petroleum products storage	2001 -present
GATX Terminals Corporation	Refined petroleum products storage	1974 - 2001
Phillips Petroleum and other operating names	Refined petroleum products storage	1918 - 1974

5. PROPERTY DESCRIPTION

The Site is approximately 15 acres located at 11400 NW St. Helens Road at the northeast corner of the community of Linnton, on a narrow strip of land between the Willamette River and the Portland Hills (Supplemental Figure 1, Delta). The site has 34 tanks with a total storage capacity of about 20 million gallons. Currently, many of the tanks are unused. The tanks are connected via a piping system to the Olympic Pipeline, the SFPP LP Pipeline (formerly Santa Fe Pacific Pipeline), the truck loading rack (unused), the rail-car loading rack (unused) and to the Site dock facilities. The Site dock facilities are used for the transfer of refined petroleum products to and from barges and ships. The Site dock facilities use is limited with nearly all products entering and leaving the Site by pipeline. Buildings on the Site consist of four warehouses (designated as "A" through "D"), the boiler and pump house, an electrical house, a maintenance shop and an office which is connected to warehouse "A". Currently, only the office, maintenance shop and part of Warehouse "C" are used regularly, the remaining warehouse space appears to be rarely used. The northern one-third of the facility is almost entirely surfaced with concrete pavement and building floor slabs, while the AST containment area (tank yards) and remaining portions of the property are surfaced with imported gravel and sandy soil. Access to the Site is restricted with fences on all sides and security personnel 24 hours per day.

The Site is bound on the northeast by the Willamette River and on the northwest by a Portland & Western Railroad right-of-way with an active rail line. The former Linnton Planing Mill and Owens-Corning Fiberglass/Trumbull Asphalt facility is located to the north-northwest of the Site and a steel yard (formerly West Coast Adhesives) is located to the south-southeast. Site zoning by the City of Portland is Heavy Industrial. The adjacent properties of the north (former Linnton Planing Mill and Owens-Corning Fiberglass/Trumbull Asphalt facility) and to the south (steel yard) are also zoned Heavy Industrial. Properties to the northwest (across the Portland & Western Railroad right-of-way and along NW St. Helens Road) are zoned employment general (EG1).

The rail car loading rack was taken out of service in 1997 and the truck loading rack was taken out of service in March 2000. The Site dock facilities, on the Willamette River, are used for loading and unloading of petroleum fuels, however, use of the dock is limited, and nearly all products enter and leave the Site by pipeline. The aboveground storage tanks (ASTs) are all located within containment walls. Storm water that collects within the AST containment area collects into a series of storm water collection sumps. These sumps are plumbed to an American Petroleum Institute (API) oil-water separator, then pumped to a storage tank, and sampled prior to discharge under a general NPDES storm water discharge permit. Limited site operations and site controls limit potential pathways for contaminants to reach the Willamette River.

Kinder Morgan leases one submerged area from the Oregon Department of State Lands (Number 7445). The area is approximately 100-ft square surrounding the northwest corner of the dock. The area is used for spill boom storage and a boathouse.

6. CURRENT SITE USE

The Site currently is operated as a bulk petroleum facility. Currently, many of the ASTs are unused. The tanks are connected via a piping system to the Olympic Pipeline, the SFPP LP Pipeline (formerly Santa Fe Pacific Pipeline), the truck loading rack (unused), the rail-car loading rack (unused) and to the Site dock facilities. The truck loading rack and rail-car loading rack are no longer is use. The Site dock facilities use is limited with nearly all products entering and leaving the Site by pipeline.

7. SITE USE HISTORY

The Site has operated as a bulk petroleum facility since the installation of ASTs as early as 1918.

8. CURRENT AND HISTORIC SOURCES AND COPCS

The understanding of historic and current potential upland and overwater sources at the site is summarized in Table 1. The following sections provide a brief overview of the potential sources and COPCs at the site requiring additional discussion.

Releases of petroleum products from the storage and distribution system appear to be the primary release mechanism for petroleum hydrocarbons and the other associated chemicals to enter the Site in soil and groundwater.

8.1. Uplands

Table 1 of the *Draft Remedial Investigation* report (KHM Environmental Management, Inc, October 2002) provides a summary of the documented releases history of the Site. A majority of those documented releases were reported to occur at the dock facilities and are listed with the overwater activities (below). Based on the results of the RI sampling and analytical program, a list of COPCs was developed for the Site to include only those contaminants that were positively identified in soil and groundwater somewhere on the Site. The Draft RI report identified 1,2-dichloroethane, benzene, naphthalene, and n-propylbenzene as groundwater COPCs for the Site. Benzo(a)anthrancene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, n-propylbenzene, lead, benzene, naphthalene, chromium, and arsenic are identified as soil COPCs for the Site.

8.2. Overwater Activities

☒ Yes ☐ No

Historically the KMLT dock was used for regular scheduled offloading of petroleum products from barges and ships as well as the refueling of tugboats. Currently, the dock is used occasionally for the offloading of petroleum products from barges and ships. The dock is no longer used for the refueling of tugboats. The following summary of documented overwater releases (activities at the Site dock facilities) is taken from Table 1 of the *Draft Remedial Investigation* report (KHM Environmental Management, Inc., October 2002).

8.3. Spills

As stated in the *Draft Remedial Investigation* report (KHM Environmental Management, Inc., October 2002), a December 1994 diesel release from a diesel line near the northern approach of the Site dock facilities is the only historical documented upland release at the Site not included in the table below. In response to the December 1994 release, four monitoring wells (MW-1 through MW-4) were installed in 1995 in the vicinity of release. All other documented releases were reported to occur at the dock facilities and are listed above. This information was gathered by review of the DEQ SPINS database and the Coast Guard and National Response Center's database.

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Date	Material(s) Released	Volume Spilled (gallons)	Spill Surface (gravel, asphalt, sewer)	Action Taken (yes/no)
07/06/72	Gasoline	5 - 20	Dock Area – Drained from hose after product transfer.	
02/27/73	Fuel Oil	Unspecified	Dock Area – Details not available.	
07/26/82	Oil	Seepage	Bypassed subsurface seepage control system.	
05/10/89	Diesel Fuel	50 – 100	Dock Area – lost during product transfer.	
11/26/92	Unleaded Gasoline	4 – 5	Dock Area – drained from hose after product transfer; 4 – 5 gallons.	
08/10/94	Oil	10	Dock Area – release during product transfer.	
11/11/95	Diesel Fuel	Sheen	Sheen observed on river – area near 1994 diesel fuel release from transfer line.	
10/16/97	Unleaded Gasoline	20	Dock Area - Ten-inch valve cracked into two. Most gasoline contained in dock containment.	
10/03/98	Unleaded Gasoline	200	Dock Area - Check valve in 6-inch dock transfer line broke.	

9. PHYSICAL SITE SETTING

9.1. *Geology*

The Site's soil profile is typified by a layer of fill covering alluvium. The source of the fill (silt and sand) is likely from dredging activities on the Willamette and Columbia Rivers. Based on borings, the fill material has been identified to an approximate depth of 35 feet below ground surface (the maximum depth explored on-site) near the river and only 1 foot below grade in the borings furthest from the river near the western property boundary. Holocene alluvial deposits underlie the fill material. It is estimated that the thickness of alluvium is approximately 60 feet in the area of the Site. In general, the alluvium beneath the Site consists of alternating layers of sandy silt, silt, silty sand, sand with occasional layers of sandy gravel, gravelly sand, or clayey silt containing organics to the total depth explored. Figure 2 presents a cross section prepared by the Lower Willamette Group of the Site's shallow subsurface stratigraphy. Investigation activities conducted at the Site have not assessed the depth at which the basalt formation exists beneath the Site. It is estimated, based upon the findings of other drilling activities in the region along the Willamette River, that the basalt unit is present at approximately 50 to 100 feet below grade.

9.2. *Hydrogeology*

Currently the 32 monitoring wells/piezometers/recovery wells are used as part of the groundwater-monitoring network for the Site (Figure 3). All wells present at the Site are screened in a single, shallow aquifer, with most of the monitoring wells screened to a depth of approximately 25 feet below grade. Based on the most recent groundwater monitoring and sampling event, completed on April 28th and 29th, 2004 the depth to groundwater measurements ranged from 11.12 feet (in MW-16) to 23.21 feet (in MW-5). Based on the groundwater level measurements taken from twenty-nine wells during this monitoring event, the groundwater flow direction appears to be generally to the northeast, toward the Willamette River.

A pump test was started in the morning on May 13, 2003 at 10:06 AM and was shut down after a 24-hour period. During the test, the groundwater extraction rate from Well RW-2 ranged from 2.25 to 3.25 gallons per minute (gpm) with an average extraction rate of approximately 2.5 gpm. The draw down in the pumping well was approximately 13 feet during the pump test. This resulted in a draw down of approximately 1.5 feet in the adjacent recovery well (RW-3) which is located approximately 35 feet south of the pumping well. The pumping well and observation wells used in the pump test are partially penetrating wells in an unconfined aquifer. The Moench Method analysis calculated a hydraulic conductivity (K) of 19.4 feet per day (ft/d). This calculated hydraulic conductivity is within the range of hydraulic conductivities typical of silty sand, which is the soil type of the aquifer as identified in the installation of the recovery wells.

During January 2002, an apparent petroleum hydrocarbon sheen was noticed on the Willamette River along the seawall of the Site. During the completion of the Remedial Investigation (RI), KMLT extensively investigated the upland area near this apparent hydrocarbon seep. In July 2004, KMLT completed the installation and start-up of the IRAM Area Containment System that consist of five four-inch diameter groundwater recovery wells RW-1 through RW-5) along the seawall near the southern half of the riverfront. This IRAM Area Containment System (system) is designed to control groundwater flow in the area of the SPH seep and the recovery of SPH from the five recovery wells and from MW-2 and MW-19. A seep and iron (ferric hydroxide) staining on beach is occasionally observed at the northern end of the riverfront.

10. NATURE AND EXTENT *(Current Understanding)*

In a March 13, 2003 letter to the DEQ (*Comments to the Draft RI Report*, KHM Environmental Management, Inc.), in regards to a comment about the Locality of Facility, it is stated that the COPCs near the site's down gradient property boundaries are below the appropriate human health and ecological screening levels, indicating that additional assessment is not warranted at this time to further define the lateral extent of petroleum hydrocarbons constituents in groundwater with the exception of further definition of dissolved petroleum hydrocarbons down gradient of MW-13. The western (up-gradient) extent of petroleum hydrocarbons is currently being assessed. Recent Geoprobe® borings and two additional monitoring wells have been installed near the former rail-car loading rack on the western side of the Site to further defined SPH occasionally observed in MW-16 associated with past rail car loadong/unloading operations. The eastern extent of the petroleum hydrocarbons in groundwater is addressed by on-going monitoring of the groundwater monitoring well network and the operation of the IRAM Area Containment System. Potential changes and trends in the concentrations of petroleum hydrocarbon constituents in the groundwater at the Site continue to be evaluated as part of the on-going groundwater monitoring and sampling program.

10.1. Soil

10.1.1. Upland Soil Investigations ☒ Yes ☐ No

A total of 27 subsurface soil samples representing a range of geographic coverage were submitted for laboratory analysis. These samples were collected during the RI field work in January, February, and April of 2002. Select soil samples were submitted for analysis by TPH-G (NW TPH-Gx), TPH-D (NW TPH-Dx), BTEX and naphthalene (EPA 8021B), VOCs (EPA 8260B), SVOCs (EPA 8270C), PAHs (8270M-SIM), and total metals (EPA 6000/7000 series). The Draft RI report identified benzo(a)anthrancene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, n-propylbenzene,

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lead, benzene, naphthalene, chromium, and arsenic as soil COPCs for the Site. The following table presents the minimum and maximum concentration detected (detected above the MRL) for each of the COPCs for soil:

Analyte	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Concentration
Benzo(a)anthrancene	0.03	15.3	SS-26 (surface soil)
Benzo(a)pyrene	0.03	14.8	SS-26 (surface soil)
Benzo(b)fluoranthene	0.023	16	SS-01(surface soil)
Dibenzo(a,h)anthracene	0.01	4.56	SS-26 (surface soil)
Indeno(1,2,3-cd)pyrene	0.011	11.5	SS-01, SS-26
N-propylbenzene	0.0421	14.9	MW-12
lead	4.15	3,570	SS-16 (surface soil)
benzene	0.00759	26.9	P-4
Naphthalene	0.012	164	HO-2
Chromium	6.93	2,360	SS-27 (surface soil)
Arsenic	1.14	80.7	SS-08 (surface soil)

10.1.2. Riverbank Samples ☐ Yes ☒ No

10.1.3. Summary

As presented in the Draft RI report, the Site-related risks and hazards are calculated for the reasonable maximum exposure and the central tendency exposure for each pathway, a calculation that overestimates risks for the majority of the population in order to ensure that public health is protected. Risks and hazards for construction workers were below target health goals for all chemicals and pathways evaluated. Risks for on-site workers were 2 x 10^{-5}, due to soil ingestion and dermal contact primarily of benzo(a)pyrene, and secondarily due to arsenic and dibenz(a,h)anthracene. The risks for these three compounds are driven by three soil concentrations within the tank farms. The tank farm soils are covered by gravel, limiting soil contact, and workers do not spend the majority of their time in that area. Thus, the estimated risks calculated in this document likely overestimate the actual risks for workers.

10.2. Groundwater

10.2.1. Groundwater Investigations ☒ Yes ☐ No

Groundwater assessment activities at the Site consist of sampling from the existing site monitoring well network and groundwater samples for Geoprobe® boring locations. Currently the 32 monitoring wells/piezometers/recovery wells are used as part of the groundwater monitoring network for the Site. During normal groundwater monitoring (depth-to-product/depth-to-water measurements) and sampling events, approximately 25 to 29 wells are monitored and approximately 10 to 15 wells are sampled. All Site wells are screened in a single, shallow aquifer.

10.2.2. NAPL (Historic & Current) ☒ Yes ☐ No

During the October 2003 groundwater monitoring and sampling event, 14 of the 32 wells gauged during this event contained measurable amounts for Non-aqueous Phase Liquid

(NAPL) or SPH, with the greatest apparent SPH thicknesses measured in recovery well RW-3. The SPH is composed of a mixture of mostly diesel with a small amount of gasoline with the exception of the SPH consistently observed in Well MW-11. The SPH observed in Well MW-11 is of a high viscosity mostly composed of Bunker C type oil. All 14 wells with measurable SPH are located in the same proximity, with five wells used as groundwater and SPH recovery wells (RW-1 through RW-5) and two wells used for SPH recovery (MW-2 and MW-19). This IRAM Area Containment System (system) is designed to control groundwater flow in this area and to recover of SPH.

10.2.3. Dissolved Contaminant Plumes ☒ Yes ☐ No

Plume Characterization Status ☐ Complete ☒ Incomplete

Characterization of the COPC associated with the Site is documented in the *Draft Remedial Investigation* report (KHM Environmental Management, Inc., October 2002) and on-going groundwater monitoring reports. The extent of the COPCs in groundwater (plume) is discussed below.

Plume Extent

In response to DEQ comments regarding the Locality of Facility for the Site, a March 13, 2003 letter to the DEQ (*Comments to the Draft RI Report*, KHM Environmental Management, Inc.) stated that the COPCs near the down gradient property boundaries are below the appropriate human health and ecological screening levels, indicating that additional assessment is not warranted at this time to further define the downgradient extent of petroleum hydrocarbons constituents in groundwater at the Site. The western (up-gradient) extent of petroleum hydrocarbons is currently being assessed. Recent Geoprobe® borings and two additional monitoring wells have been completed near the former rail-car loading rack on the western side of the Site to further define SPH associated with the former operations of the railcar loading rack. The eastern extent of the petroleum hydrocarbons in groundwater is addressed by on-going monitoring of the groundwater monitoring well network and the operation of the IRAM Area Containment System. Potential changes and trends in the concentrations of petroleum hydrocarbon constituents in the groundwater at the Site continue to be evaluated as part of the on-going groundwater monitoring and sampling program.

Min/Max Detections (Current situation)

The Human Health and Ecological Risk Assessments presented in the Draft RI report identified 1,2-dichloroethane, benzene, naphthalene, and n-Propylbenzene as groundwater COPCs for the Site. The following table is taken from the Draft RI report and presents the minimum and maximum concentration detected (detected above the MRL) for each of the COPCs in groundwater.

Analyte	Minimum Detected Concentration (µg/l)	Maximum Detected Concentration (µg/l)	Location of Maximum Detected Concentration
1,2-Dichloroethane	0.25	0.61	MW-6
Benzene	2.85	420	MW-9
Naphthalene	0.0968	2,340	HO-2
N-Propylbenzene	0.21	308	MW-13

Current Plume Data

The following table presents the analysis from October 2003 groundwater sampling. Groundwater sampling in October 2003 was limited to BTEX and TPH analysis, accordingly, no values are available for Naphthalene, 1,2-dichloroethane, nor n-Propylbenzene. The plume map presented as Figure 3 shows the location and the highest concentration detected of each COPC at the site. In addition, the plume map presents the extent of measureable SPH at the site.

Analyte	Minimum Detected Concentration (µg/l)	Maximum Detected Concentration (µg/l)	Location of Maximum Detected Concentration
Benzene	0.927	77.9	MW-16

Preferential Pathways

No preferential pathways for groundwater or SPH have been identified at this Site.

Downgradient Plume Monitoring Points

Groundwater monitoring wells MW-1, MW-3, MW-7, MW-8, MW-13, and MW-22 are down-gradient monitoring points for the existing groundwater monitoring network. The following table presents the minimum and maximum groundwater concentrations and ecological screening level values used for the COPCs for these down-gradient monitoring wells. Groundwater sampling in 2003 was limited to BTEX + Naphthalene and TPH analysis, accordingly, values for 1,2-dichloroethane, and n-propylbenzene are from the analytical samples completed for the Draft RI report (2002).

Well	Benzene	Naphthalene	1,2-Dichloroethane	N-Propylbenzene
MW-1	Not Detected in both samples from 2003	Not Detected in both samples from 2003	Not detected in the 2002 RI sampling	11.3 µg/l detected in the 2002 RI Sampling
MW-3	Not Detected in the one 2003 sample	2.31 µg/l detected in one 2003 sample	Not detected in the 2002 RI sampling	No Sampled
MW-7	Not Detected all four of the samples from 2003	Not Detected in both samples from 2003	Not detected in the 2002 RI sampling	Not detected in the 2002 RI sampling
MW-8	Concentrations range from 0.927 to 15.8 µg/l in the four 2003 Samples	Concentrations range from 5.89 to 23.1 µg/l in the two 2003 Samples	Not detected in the 2002 RI sampling	47.5 µg/l detected in the 2002 RI Sampling
MW-13	Concentrations range from 2.18 to 107 µg/l in the four 2003 Samples	Not Detected in both samples from 2003	Not detected in the 2002 RI sampling	308 µg/l detected in the 2002 RI Sampling
MW-22	Concentrations range from ND to 11.7 µg/l in the three 2003 Samples	Not Detected in the one sample collected in 2003	Not Sampled for this COPC (Installed in 2003 after RI sampling)	Not Sampled for this COPC (Installed in 2003 after RI sampling)
Screening Level Values	**130 µg/l** – DEQ Level II SLV for surface water (fresh) aquatic receptor	**620 µg/l** – DEQ Level II SLV for surface water (fresh) aquatic receptor	**280 µg/l** – DEQ RBC for GW in an excavation – excavation worker scenario. There is not an established Level II screening level for this compound.	**1,600 µg/l** – DEQ RBC for GW in an excavation – excavation worker scenario. There is not an established Level II screening level for this compound.

Visual Seep Sample Data ☐ Yes ☒ No

No visual seep data are available.

Nearshore Porewater Data

None

GW Plume Temporal Trend

No analysis of the potential trends regarding the groundwater plume has been completed for the Site.

10.2.4. Summary

Based on the *Draft Remedial Investigation* report and groundwater monitoring reports, the groundwater flow direction at the Site generally appears to be northeasterly, toward the Willamette River. The eastern extent (seep area) of the petroleum hydrocarbons in groundwater is addressed by on-going monitoring of the groundwater monitoring well network and the operation of the IRAM Area Containment System. This system is designed to control groundwater flow in the area of the SPH seep and the recovery of SPH from the five recovery wells and from MW-2 and MW-19. Groundwater control is accomplished by the simultaneous extraction of groundwater from the five recovery wells RW-1 through RW-5. Extracted groundwater is treated with a sand-filter followed by activated carbon. Treated groundwater is discharged to the Willamette River under a 1500A General NPDES discharge permit. Outside the IRAM Area, groundwater-monitoring wells MW-1, MW-3, MW-7, MW-8, MW-13, and MW-22 are down-gradient monitoring points for the existing groundwater monitoring network for the Site. Concentrations of the Site groundwater COPCs measured in these wells are non-detect or below the screening level values. Only two of the COPCs (naphthalene and benzene) have DEQ Level II ecological screening levels established. These levels are 620 μg/l for naphthalene and 130 μg/l for benzene. Potential changes and trends in the concentrations of petroleum hydrocarbon constituents in the groundwater at the Site continue to be evaluated as part of the on-going groundwater monitoring and sampling program.

10.3. Surface Water

10.3.1. Surface Water Investigation ☐ Yes ☒ No

10.3.2. General or Individual Stormwater Permit (Current or Past) ☒ Yes ☐ No

As presented in the direct discharge section (above), the stormwater from the AST containment area, under normal conditions, discharges from the two API oil-water separators and is pumped into AST 3034 where it is sampled prior to batch discharge. During larger precipitation events, once AST 3034 is full, storm water is visually inspected at the effluent end of the API oil-water separator and discharged to the Willamette River. Storm water is discharged from the Site under a 1300 general NPDES storm water discharge permit. The limited site operations and site controls limit potential pathways for contaminants to reach the Willamette River via stormwater.

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Permit Type	File Number	Start Date	Outfalls	Parameters/Frequency
GEN 1300J (NPDES general permit)	10287	07/31/2001	Willamette River	Storm water run-off (Standard requirements)

Do other non-stormwater wastes discharge to the system? ☐ Yes ☒ No

10.3.3. Stormwater Data ☒ Yes ☐ No

Storm water sampling has been completed per the permit requirements and sampling results have been in compliance with the permit limitations. In addition to the general storm water permit sampling requirements, Kinder Morgan has voluntarily collected two rounds of samples from the storm water discharge for total metals analysis. Samples were collected on November 14, 2002 and December 16, 2002 and analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver by EPA 6000/7000 series methods. Only barium and lead were detected above the MRLs; barium at a concentration of 0.019 and 0.022 mg/l and lead at 0.010 mg/l and non-detect in the December 16 sample.

10.3.4. Catch Basin Solids Data ☐ Yes ☒ No

10.3.5. Wastewater Permit ☐ Yes ☒ No

Permit Type	Permit No.	Start Date	Outfalls	Volumes	Parameters/Frequency
GEN 1500A (NPDES general permit)	17609	02/12/2003	Willamette River	N/A	Petroleum hydrocarbons cleanup (Standard Requirements)

10.3.6. Wastewater Data ☒ Yes ☐ No

Sampling of the discharge from the IRAM Area Containment System (1500A general permit) has been completed per the permit requirements and sampling results have been in compliance with permit limitations.

10.3.7. Summary

Storm water and waste water sampling has shown that the Site is in compliance with sampling requirements and the associated permit discharge limitations. Voluntarily sampling of the storm water discharge for total metals analysis has shown that only barium and lead were detected above the MRLs.

10.4. Sediment

10.4.1. River Sediment Data ☐ Yes ☒ No

Three sediment investigations have occurred offshore of Kinder Morgan since 1997 (see Figure 1). Weston (1998) collected sediment from five sampling locations: SD024, upstream from the Kinder Morgan dock; SD019 and SD020 both located off the Kinder Morgan dock, and SD017 and SD018, both located downstream from the dock. During both the Site Assessment and RI of the Site, KHM Environmental (2002) collected surface sediment data inshore or in line with the dock. Finally, the Army Corps of Engineers, Portland District, collected a core sample approximately 300 ft off the southern portion of the site for analysis of dioxin congeners and furans. Sediment data from these investigations are summarized in Table 2. Metals (copper, lead, and zinc) and PAHs were detected in the sediment samples. Sediment will be collected from 10 locations off the Site during the LWG's Round 2 sampling program. Subsurface sediment will be collected from four of the 10 locations.

10.4.2. Summary

See Final CSM Update.

11. CLEANUP HISTORY AND SOURCE CONTROL MEASURES

11.1. Soil Cleanup/Source Control

The October 2002 Draft RI completed for the Site includes a preliminary hot spot analysis for soil, based on the DEQ guidance for highly concentrated and highly mobile hot spots in soil. Based on this analysis for highly concentrated or highly mobile hot spots in soil, no preliminary hot spots in soil were identified at the Site.

11.2. Groundwater Cleanup/Source Control

As presented above, in July 2004, KMLT completed the installation and start-up of the IRAM Area Containment System that consists of five four-inch diameter groundwater recovery wells RW-1 through RW-5) along the seawall near the southern half of the riverfront to address the observation of a hydrocarbon sheen. This system is designed to control groundwater flow in the area of the SPH seep and the recovery of SPH from the five recovery wells and from MW-2 and MW-19.

11.3. Other

11.4. Potential for Recontamination from Upland Sources

See Final CSM Update.

12. BIBLIOGRAPHY / INFORMATION SOURCES

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KHM Environmental Management, Inc. letter to DEQ, Comments to the Draft RI Report, March 12, 2003. Prepared for Kinder Morgan Liquid Terminals by KHM Environmental Management, Inc.

Figures:

Tables:

Supplemental Figures:

FIGURES

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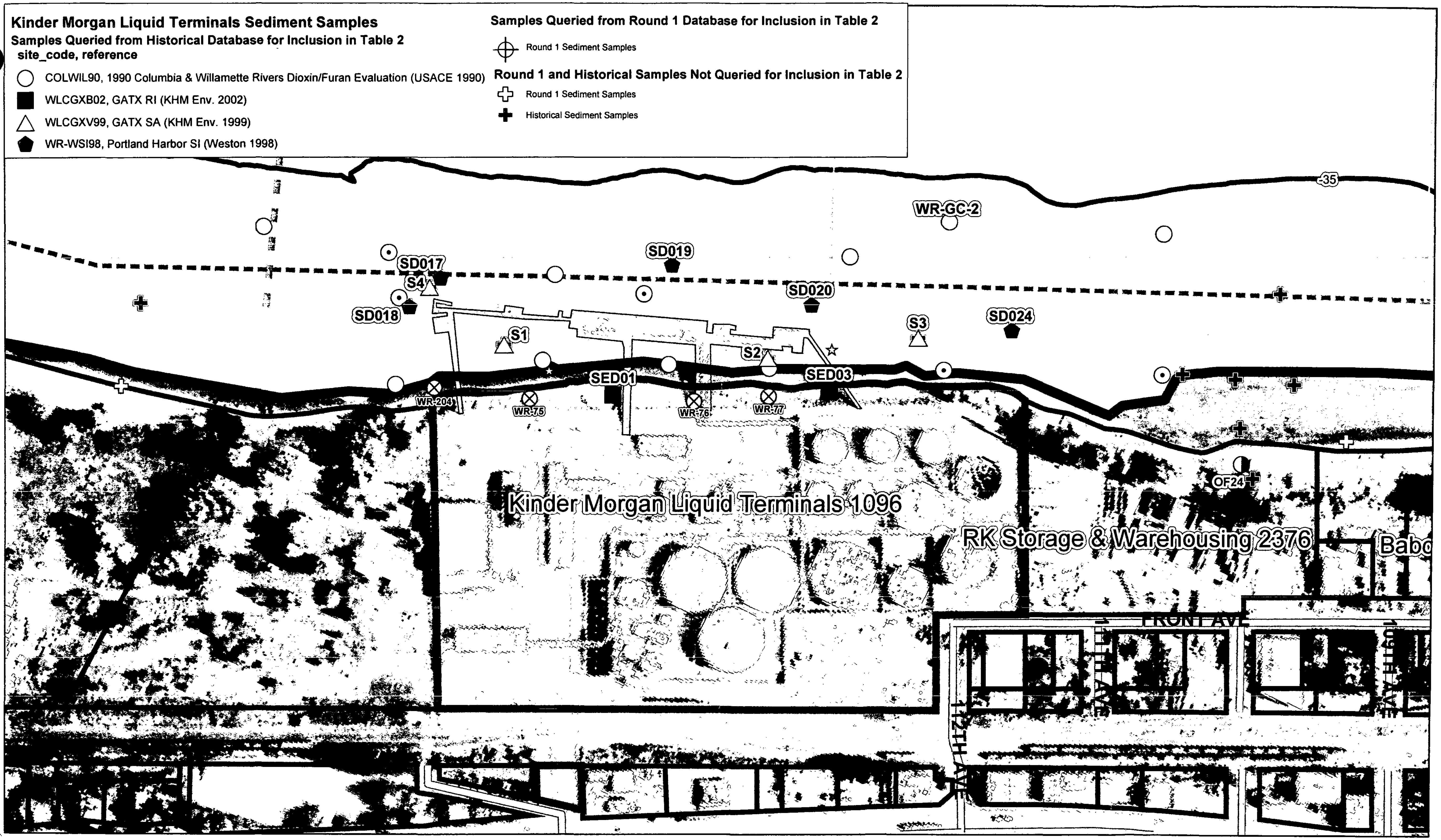

integral

LWG Lower Willamette Group

Map Document: (C:\GIS\Projects\Portland_Harbor\LWG-Map-Projects\Conseptual_Site_Model\Sample_Locations.mxd)
Plot Date: 08/10/2004

Areal Photo Date: October 2001.
Base Map features from Portland Metro's RLIS.

The City of Portland Outfall mapping information is based on available records; no warranty, expressed or implied, is provided as to the completeness or accuracy of the information. Current layer updated June 2004.

Outfalls (private)
City Outfalls
City Outfalls (Abandoned)
Seep Photo Location (Not location of actual Seep)

River Miles
Navigation Channel
-35ft. Contour (NAVD 88)
Docks & In-water Structures
Selected ECSI Site Property Boundary

Human Use Areas
Dockside Worker
Recreational Beach Use
Transient

LWG Round 2 Proposed Sediment Samples
Surface Sample Only
Core & Surface Sample

0 100 200 400 Feet

DRAFT

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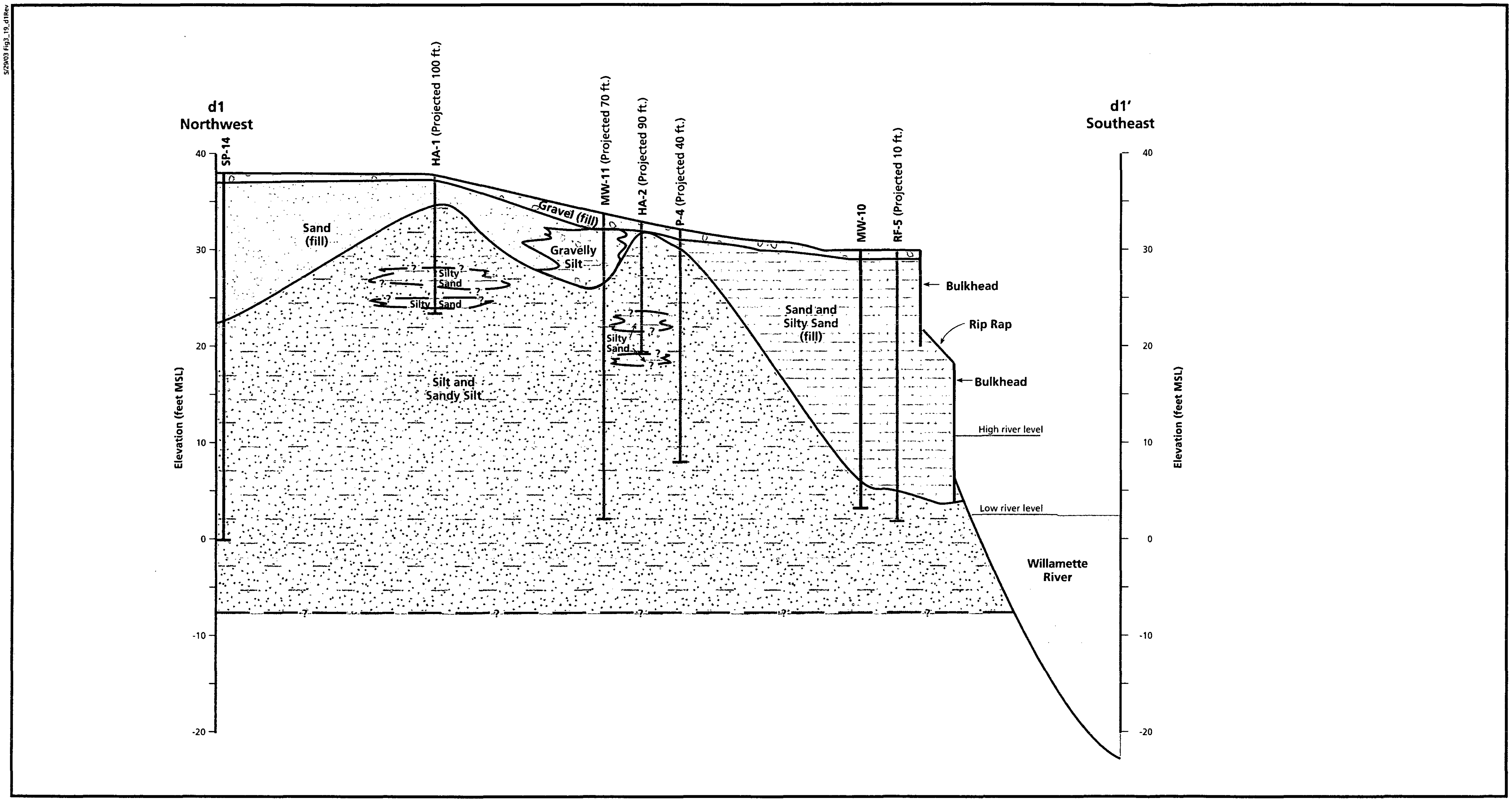
Figure 1
Portland Harbor
Conceptual Site Model
Kinder Morgan
Liquid Terminals
ECSI 1096

5/29/03 Fig3_19_d1Rev



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LWG LOWER WILLAMETTE GROUP

Groundwater Solutions Inc.

LEGEND

0 100 200
HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION = 10X

Scale and elevations are approximate.

Reference: Location of boreholes based on Figure 19 in Remedial Investigation, Kinder Morgan Liquid Terminals, LLC, KHM Environmental Management, Inc., October, 2002.

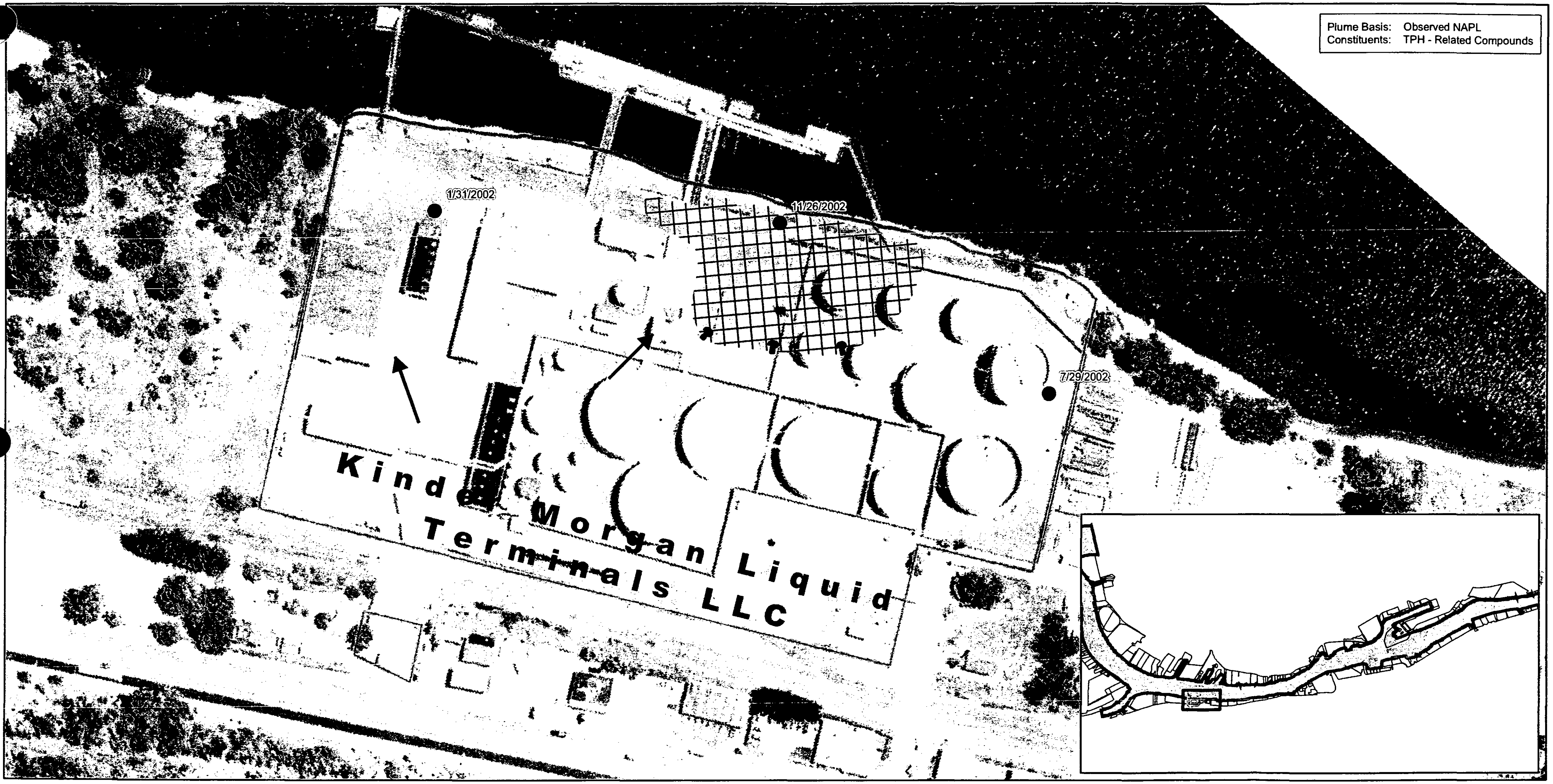
LW-6D — Boring/Well ID
Surface elevation along profile
Groundwater level
Boring/Well, Projected
Well screen
Bottom of boring/well

Fill:
- Sand
- Gravel
- Sand and Silty Sand

Pleistocene Flood Deposits and Recent Alluvium (undifferentiated sand and silt):
- Gravelly Silt
- Silty Sand
- Silt and Sandy Silt

Figure 2
Portland Harbor RI/FS
Hydrogeologic Cross Section d1-d1'
GATX Linnton Terminal
GROUNDWATER SOLUTIONS, INC.

DRAFT



Groundwater Solutions Inc.

LWG LOWER WILLAMETTE GROUP

0 125 250 Feet

FEATURE SOURCES:
Transportation, Water, Property, Zoning or Boundaries: Metro RLIS.
ECSI site locations were summarized in December, 2002
and January, 2003 from ODEQ ECSI files.

Map Creation Date: August 24, 2004

File Name: Fig3_KinderMorg_SummaryMap.mxd

LEGEND

Site Boundary

Maximum Detection Location

General Groundwater Flow

Contaminant Type

Petroleum related

Extent of Impacted Groundwater

For details, refer to plume interpretation table in CSM document.

Single or isolated detection of COI's. Extent or continuity of impacted groundwater between sample points is uncertain. Color based on contaminant type.

Estimated extent of impacted groundwater area. Color based on contaminant type.

Figure 3
Portland Harbor RI/FS
Kinder Morgan Liquid Terminals LLC
Upland Groundwater Quality Overview

DO NOT QUOTE OR CITE:
This document is currently under review by US EPA and its federal, state and tribal partners, and is subject to change in whole or part.

TABLES

DO NOT QUOTE OR CITE.
This Document is currently under review by US EPA and its federal, state and tribal partners,
and is subject to change is whole or part.

Kinder Morgan Liquids Terminal - Linnton Petroleum Terminal (DEQ ECSI No. 1096)

Table 1. Potential Sources and Transport Pathways Assessment

Last Updated: September 17, 2004

Potential Sources	Media Impacted					COIs																		Potential Complete Pathway				
						TPH			VOCs																			
Description of Potential Source	Surface Soil	Subsurface Soil	Groundwater	Catch Basin Solids	River Sediment	Gasoline-Range	Diesel - Range	Heavier - Range	Petroleum-Related (e.g. BTEX)	VOCs	Chlorinated VOCs	SVOCs	PAHs	Phthalates	Phenolics	Metals	PCBs	Herbicides and Pesticides	Dioxins/Furans	Butyltins	[Others -List]	[Others -List]	[Others -List]	Overland Transport	Groundwater	Direct Discharge - Overwater	Direct Discharge - Storm/Wastewater	River Bank Erosion
Upland Areas																												
A																												
Petroleum Fuel Storage Areas	√	√	√				√	√	√				√			√									√			
Overwater Areas																												
A																												
Petrleum Fuel Storage Areas - Dock Operations						√	√	√																		√		
Other Areas/Other Issues																												

Notes:

[1] All information provided in this table is referenced in the site summaries. If information is not available or inconclusive, a ? may be used, as appropriate. No new information is provided in this t

✓ = Source, COI are present or current or historic pathway is determined to be complete or potentially complete

? = There is not enough information to determine if source or COI is present or if pathway is complete.

Blank = Source, COI and historic and current pathways have been investigated and shown to be not present or incomplete

UST	Underground storage tank
AST	Above-ground storage tank
TPH	Total petroleum hydrocarbons
VOCs	Volatile organic compounds
SVOCs	Semivolatile organic compounds
PAHs	Polycyclic aromatic hydrocarbons
BTEX	Benzene, toluene, ethylbenzene, and xylenes
PCBs	Polychorinated biphenols

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Aroclor 1016	(ug/kg)	5	0	0						19 U	137 U	71.4	67 U	67 U
surface	Aroclor 1242	(ug/kg)	5	0	0						19 U	137 U	71.4	67 U	67 U
surface	Aroclor 1248	(ug/kg)	5	0	0						19 U	137 U	71.4	67 U	67 U
surface	Aroclor 1254	(ug/kg)	5	0	0						19 U	137 U	71.4	67 U	67 U
surface	Aroclor 1260	(ug/kg)	5	0	0						19 U	137 U	71.4	67 U	67 U
surface	Aroclor 1221	(ug/kg)	5	0	0						38 U	274 U	143	134 U	137 U
surface	Aroclor 1232	(ug/kg)	5	0	0						19 U	137 U	71.4	67 U	67 U
surface	Polychlorinated biphenyl	(ug/kg)	5	0	0						38 UA	274 UA	143	134 UA	137 UA
surface	Butyltin ion	(ug/kg)	1	0	0						5.8 U	5.8 U	5.8	5.8 U	5.8 U
surface	Dibutyltin ion	(ug/kg)	1	0	0						5.8 U	5.8 U	5.8	5.8 U	5.8 U
surface	Dibutyltin ion	(ug/l)	1	0	0						0.06 U	0.06 U	0.06	0.06 U	0.06 U
surface	Tributyltin ion	(ug/kg)	1	1	100	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
surface	Tributyltin ion	(ug/l)	1	0	0						0.02 U	0.02 U	0.02	0.02 U	0.02 U
surface	Tetrabutyltin	(ug/kg)	1	0	0						5.8 U	5.8 U	5.8	5.8 U	5.8 U
surface	Tetrabutyltin	(ug/l)	1	0	0						0.02 U	0.02 U	0.02	0.02 U	0.02 U
surface	Total solids	(%)	6	6	100	49	84.6	65.7	62.2	74.8	49	84.6	65.7	62.2	74.8
surface	Total organic carbon	(%)	9	9	100	0.159	2.3	1.18	1.3	1.8	0.159	2.3	1.18	1.3	1.8
surface	Ammonia	(mg/kg)	4	4	100	34.4	171	99.2	41.4	150	34.4	171	99.2	41.4	150
surface	Gravel	(%)	4	4	100	0.04	0.68	0.315	0.07	0.47	0.04	0.68	0.315	0.07	0.47
surface	Sand	(%)	5	5	100	11.11	23.3	19.6	20.84	21.9	11.11	23.3	19.6	20.84	21.9
surface	Fines	(%)	5	5	100	76.02	88.42	80.2	79.09	79.29	76.02	88.42	80.2	79.09	79.29
surface	Silt	(%)	5	5	100	65.99	74.71	69.7	69.54	70.01	65.99	74.71	69.7	69.54	70.01
surface	Coarse silt	(%)	4	4	100	20.6	51.3	34.5	24.3	41.6	20.6	51.3	34.5	24.3	41.6
surface	Medium silt	(%)	4	4	100	6.7	9.1	8.35	8.6	9	6.7	9.1	8.35	8.6	9
surface	Fine silt	(%)	4	4	100	3	12.9	6.78	4.5	6.7	3	12.9	6.78	4.5	6.7
surface	Very fine silt	(%)	4	4	100	3	9.1	5.78	4.3	6.7	3	9.1	5.78	4.3	6.7
surface	Clay	(%)	5	5	100	8.52	13.71	10.5	10.03	11.08	8.52	13.71	10.5	10.03	11.08
surface	8-9 Phi clay	(%)	4	4	100		12.9	4.35		4.5	0	12.9	4.35	0	4.5
surface	9-10 Phi clay	(%)	4	4	100	4.3	12	8.03	6.7	9.1	4.3	12	8.03	6.7	9.1
surface	>10 Phi clay	(%)	4	4	100		4.5	1.13			0	4.5	1.13	0	0
surface	Sieve 4	(%)	4	4	100		8.3	2.3		0.9	0	8.3	2.3	0	0.9
surface	Sieve 10	(%)	4	4	100	0.3	7.5	2.23	0.4	0.7	0.3	7.5	2.23	0.4	0.7
surface	Sieve 20	(%)	4	4	100	0.5	5.3	1.75	0.6	0.6	0.5	5.3	1.75	0.6	0.6
surface	Sieve 40	(%)	4	4	100	1	2	1.45	1.3	1.5	1	2	1.45	1.3	1.5
surface	Sieve 60	(%)	4	4	100	1.1	3.1	2	1.6	2.2	1.1	3.1	2	1.6	2.2
surface	Sieve 140	(%)	4	4	100	2.4	7.8	5.53	5.2	6.7	2.4	7.8	5.53	5.2	6.7
surface	Sieve 200	(%)	4	4	100	0.3	4.4	2.05	1.3	2.2	0.3	4.4	2.05	1.3	2.2
surface	Sieve 230	(%)	4	4	100	2.6	6.7	5.13	5.3	5.9	2.6	6.7	5.13	5.3	5.9
surface	Aluminum	(mg/kg)	5	5	100	36800	41100	39400	39400	40700	36800	41100	39400	39400	40700
surface	Aluminum	(mg/l)	1	1	100	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
surface	Antimony	(mg/kg)	5	1	20	5 J	5 J	5	5 J	5 J	5 UJ	6 UJ	5.2	5 J	5 UJ
surface	Antimony	(mg/l)	1	0	0						0.05 U	0.05 U	0.05	0.05 U	0.05 U
surface	Arsenic	(mg/kg)	9	4	44.4	2.6	4.32	3.5	3.2	3.86	2.6	6 U	4.44	5 U	5 U
surface	Arsenic	(mg/l)	1	1	100	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
surface	Cadmium	(mg/kg)	9	5	55.6	0.2	0.4	0.34	0.4	0.4	0.2	1.02 U	0.469	0.4	0.5 U
surface	Cadmium	(mg/l)	1	0	0						0.002 U	0.002 U	0.002	0.002 U	0.002 U
surface	Chromium	(mg/kg)	9	9	100	21.5	39.3	32.3	34.7	38.7	21.5	39.3	32.3	34.7	38.7
surface	Chromium	(mg/l)	1	0	0						0.005 U	0.005 U	0.005	0.005 U	0.005 U
surface	Copper	(mg/kg)	9	9	100	22.4	44.5	34.2	37.5	41.9	22.4	44.5	34.2	37.5	41.9
surface	Copper	(mg/l)	1	0	0						0.002 U	0.002 U	0.002	0.002 U	0.002 U
surface	Lead	(mg/kg)	9	8	88.9	12	29.4	17.2	15	19.8	12	29.4	17.6	16.5	20.4 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Lead	(mg/l)	1	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Manganese	(mg/kg)	5	5	100	571	773	707	753	772	571	773	707	753	772
surface	Manganese	(mg/l)	1	1	100	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
surface	Mercury	(mg/kg)	9	7	77.8	0.05 J	0.112	0.071	0.06	0.105	0.05 J	0.112	0.0777	0.06 J	0.105
surface	Mercury	(mg/l)	1	0	0						0.0001 U	0.0001 U	0.0001	0.0001 U	0.0001 U
surface	Nickel	(mg/kg)	5	5	100	27	31	29.2	29	29.9	27	31	29.2	29	29.9
surface	Nickel	(mg/l)	1	0	0						0.01 U	0.01 U	0.01	0.01 U	0.01 U
surface	Selenium	(mg/kg)	9	5	55.6	7	12	10.8	12	12	0.5 U	12	6.28	7	12
surface	Selenium	(mg/l)	1	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Silver	(mg/kg)	9	7	77.8	0.6	1.33	0.869	0.8	1.15	0.6	2.04 U	1.01	0.8	1.33
surface	Silver	(mg/l)	1	0	0						0.0002 U	0.0002 U	0.0002	0.0002 U	0.0002 U
surface	Thallium	(mg/kg)	5	5	100	8	25	19.6	24	24	8	25	19.6	24	24
surface	Thallium	(mg/l)	1	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Zinc	(mg/kg)	9	9	100	68.8	126	94.8	93.1	114	68.8	126	94.8	93.1	114
surface	Zinc	(mg/l)	1	1	100	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
surface	Barium	(mg/kg)	9	9	100	97.5	201	164	179	192	97.5	201	164	179	192
surface	Barium	(mg/l)	1	1	100	0.138	0.138	0.138	0.138	0.138	0.138	0.138	0.138	0.138	0.138
surface	Beryllium	(mg/kg)	5	5	100	0.6	0.7	0.646	0.63	0.7	0.6	0.7	0.646	0.63	0.7
surface	Beryllium	(mg/l)	1	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Calcium	(mg/kg)	5	5	100	8020	8540	8360	8460	8500	8020	8540	8360	8460	8500
surface	Calcium	(mg/l)	1	1	100	122	122	122	122	122	122	122	122	122	122
surface	Cobalt	(mg/kg)	5	5	100	17.5 J	19.2	18.6	19 J	19.2 J	17.5 J	19.2	18.6	19 J	19.2 J
surface	Cobalt	(mg/l)	1	1	100	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
surface	Iron	(mg/kg)	5	5	100	39600	44100	42100	41800	43400	39600	44100	42100	41800	43400
surface	Iron	(mg/l)	1	1	100	8.95	8.95	8.95	8.95	8.95	8.95	8.95	8.95	8.95	8.95
surface	Magnesium	(mg/kg)	5	5	100	6560	7190	6950	7090	7120	6560	7190	6950	7090	7120
surface	Magnesium	(mg/l)	1	1	100	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8
surface	Potassium	(mg/kg)	5	5	100	1250	1580	1410	1380	1480	1250	1580	1410	1380	1480
surface	Potassium	(mg/l)	1	1	100	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
surface	Sodium	(mg/kg)	5	5	100	1080 J	1220	1160	1150	1200	1080 J	1220	1160	1150	1200
surface	Sodium	(mg/l)	1	1	100	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
surface	Titanium	(mg/kg)	1	1	100	1960	1960	1960	1960	1960	1960	1960	1960	1960	1960
surface	Vanadium	(mg/kg)	5	5	100	97.5	109	105	105	108	97.5	109	105	105	108
surface	Vanadium	(mg/l)	1	1	100	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
surface	2-Methylnaphthalene	(ug/kg)	11	1	9.09	420	420	420	420	420	19 U	3370 U	862	330 U	2640 U
surface	Acenaphthene	(ug/kg)	11	5	45.5	20	270	75.4	30	31	13.4 U	3370 U	594	134 U	1650 U
surface	Acenaphthylene	(ug/kg)	11	1	9.09	134 J	134 J	134	134 J	134 J	13.4 U	3370 U	568	20 U	1650 U
surface	Anthracene	(ug/kg)	11	6	54.5	28	134 J	57.3	36	70	13.4 U	3370 U	579	70	1650 U
surface	Fluorene	(ug/kg)	11	4	36.4	20	140	53.8	26	29	13.4 U	3370 U	581	134 U	1650 U
surface	Naphthalene	(ug/kg)	11	4	36.4	28	150	59.3	29	30	13.4 U	3370 U	583	134 U	1650 U
surface	Phenanthrene	(ug/kg)	11	8	72.7	15.4	2250	423	150	440	15.4	3370 U	704	169	2250
surface	Low Molecular Weight PAH	(ug/kg)	11	8	72.7	15.4 A	2250 A	589	273 A	1070 A	15.4 A	3370 UA	824	330 UA	2250 A
surface	Dibenz(a,h)anthracene	(ug/kg)	11	4	36.4	21	134 J	50.3	22	24	13.4 U	3370 U	569	24	1650 U
surface	Benz(a)anthracene	(ug/kg)	11	7	63.6	13.4 J	371	117	83	120	13.4 J	3370 U	621	120	1650 U
surface	Benzo(a)pyrene	(ug/kg)	11	7	63.6	13.4 J	559	166	120	150	13.4 J	3370 U	652	150	1650 U
surface	Benzo(b)fluoranthene	(ug/kg)	11	7	63.6	13.7	450	135	99	140	13.7	3370 U	632	140	1650 U
surface	Benzo(g,h,i)perylene	(ug/kg)	11	8	72.7	13.4 J	1750	347	69 J	657	13.4 J	3370 U	649	90	1750
surface	Benzo(k)fluoranthene	(ug/kg)	11	7	63.6	13.4 J	397	124	95	110	13.4 J	3370 U	625	110	1650 U
surface	Chrysene	(ug/kg)	11	7	63.6	14.3	512	163	120	160	14.3	3370 U	650	160	1650 U
surface	Fluoranthene	(ug/kg)	11	8	72.7	33	2660	551	230	552	33	3370 U	797	330 U	2660
surface	Indeno(1,2,3-cd)pyrene	(ug/kg)	11	7	63.6	13.4 J	419	111	66	79	13.4 J	3370 U	617	79	1650 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Pyrene	(ug/kg)	11	9	81.8	27.1	4260	1110	240	3710	27.1	4260	995	330 U	3710
surface	Benzo(b+k)fluoranthene	(ug/kg)	9	5	55.6	124 A	240 A	189	195 A	196 A	124 A	3370 UA	773	240 A	1650 UA
surface	High Molecular Weight PAH	(ug/kg)	11	9	81.8	155.1 A	8670 A	2560	1163 A	4849 A	155.1 A	8670 A	2190	1128 A	4849 A
surface	Polycyclic Aromatic Hydrocarbons	(ug/kg)	11	9	81.8	170.5 A	10920 A	3080	1461 A	5286 A	170.5 A	10920 A	2610	1401 A	5286 A
surface	4,4'-DDD	(ug/kg)	5	2	40	1.4 J	18.3	9.85	1.4 J	1.4 J	1.4 J	41 U	18.8	18.3	26.8 U
surface	4,4'-DDE	(ug/kg)	5	1	20	1.2 J	1.2 J	1.2	1.2 J	1.2 J	1.2 J	41 U	16.5	6.7 U	26.8 U
surface	4,4'-DDT	(ug/kg)	5	2	40	1.9 J	10.9	6.4	1.9 J	1.9 J	1.9 J	41 U	17.5	10.9	26.8 U
surface	Total of 3 isomers: pp-DDT,-DDD,-DDE	(ug/kg)	5	2	40	4.5 A	29.2 A	16.9	4.5 A	4.5 A	4.5 A	41 UA	21.6	26.8 UA	29.2 A
surface	Aldrin	(ug/kg)	5	0	0						0.96 U	41 U	16.4	6.7 U	26.8 U
surface	alpha-Hexachlorocyclohexane	(ug/kg)	5	0	0						0.96 U	41 U	16.4	6.7 U	26.8 U
surface	beta-Hexachlorocyclohexane	(ug/kg)	5	0	0						0.96 U	41 U	16.4	6.7 U	26.8 U
surface	delta-Hexachlorocyclohexane	(ug/kg)	5	0	0						0.96 U	41 U	16.4	6.7 U	26.8 U
surface	gamma-Hexachlorocyclohexane	(ug/kg)	5	0	0						0.96 U	41 U	16.4	6.7 U	26.8 U
surface	cis-Chlordane	(ug/kg)	5	0	0						0.96 U	41 U	16.4	6.7 U	26.8 U
surface	trans-Chlordane	(ug/kg)	4	0	0						6.7 U	41 U	20.3	6.7 U	26.8 U
surface	Dieldrin	(ug/kg)	5	0	0						1.9 U	41 U	16.6	6.7 U	26.8 U
surface	alpha-Endosulfan	(ug/kg)	5	0	0						0.96 U	41 U	16.4	6.7 U	26.8 U
surface	beta-Endosulfan	(ug/kg)	5	0	0						1.9 U	41 U	16.6	6.7 U	26.8 U
surface	Endosulfan sulfate	(ug/kg)	5	0	0						1.9 U	41 U	16.6	6.7 U	26.8 U
surface	Endrin	(ug/kg)	5	0	0						1.9 U	41 U	16.6	6.7 U	26.8 U
surface	Endrin aldehyde	(ug/kg)	5	0	0						1.9 U	41 U	16.6	6.7 U	26.8 U
surface	Endrin ketone	(ug/kg)	5	0	0						1.9 U	41 U	16.6	6.7 U	26.8 U
surface	Heptachlor	(ug/kg)	5	0	0						0.96 U	41 U	16.4	6.7 U	26.8 U
surface	Heptachlor epoxide	(ug/kg)	5	0	0						0.96 U	41 U	16.4	6.7 U	26.8 U
surface	Methoxychlor	(ug/kg)	5	0	0						6.7 U	41 U	18.2	9.6 U	26.8 U
surface	Toxaphene	(ug/kg)	5	0	0						96 U	1220 U	503	200 U	800 U
surface	gamma-Chlordane	(ug/kg)	1	0	0						0.96 U	0.96 U	0.96	0.96 U	0.96 U
surface	Chlordane (technical)	(ug/kg)	4	0	0						150 U	919 U	455	150 U	600 U
surface	Diesel fuels	(mg/kg)	2	1	50	173	173	173	173	173	25 U	173	99	25 U	25 U
surface	Gasoline	(mg/kg)	2	2	100	2 J	2 J	2	2 J	2 J	2 J	2 J	2	2 J	2 J
surface	Fuel oil no. 2	(mg/kg)	2	1	50	401	401	401	401	401	50 U	401	226	50 U	50 U
surface	2,4,5-Trichlorophenol	(ug/kg)	11	0	0						96 U	3370 U	861	330 U	2640 U
surface	2,4,6-Trichlorophenol	(ug/kg)	11	0	0						96 U	3370 U	861	330 U	2640 U
surface	2,4-Dichlorophenol	(ug/kg)	11	0	0						58 U	3370 U	843	330 U	2640 U
surface	2,4-Dimethylphenol	(ug/kg)	11	0	0						19 U	10200 U	2480	1000 U	8000 U
surface	2,4-Dinitrophenol	(ug/kg)	11	0	0						190 UJ	16000 U	2270	330 U	3370 U
surface	2-Chlorophenol	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	2-Methylphenol	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	2-Nitrophenol	(ug/kg)	11	0	0						96 U	3370 U	861	330 U	2640 U
surface	4,6-Dinitro-2-methylphenol	(ug/kg)	11	0	0						190 UJ	10200 U	2560	1000 U	8000 U
surface	4-Chloro-3-methylphenol	(ug/kg)	11	0	0						38 U	3370 U	834	330 U	2640 U
surface	4-Methylphenol	(ug/kg)	5	1	20	370	370	370	370	370	19 U	370	89.4	19 U	20 U
surface	4-Nitrophenol	(ug/kg)	11	0	0						96 UJ	10200 U	2520	1000 U	8000 U
surface	Pentachlorophenol	(ug/kg)	11	0	0						96 U	10200 U	2520	1000 U	8000 U
surface	Phenol	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	3- and 4-Methylphenol Coelution	(ug/kg)	4	0	0						330 U	3370 U	1500	660 U	1650 U
surface	Cresol	(ug/kg)	2	0	0						330 U	2640 U	1490	330 U	330 U
surface	Dimethyl phthalate	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	Diethyl phthalate	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	Dibutyl phthalate	(ug/kg)	11	0	0						19 U	10200 U	2480	1000 U	8000 U
surface	Butylbenzyl phthalate	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U

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Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Di-n-octyl phthalate	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	Bis(2-ethylhexyl) phthalate	(ug/kg)	11	1	9.09	120	120	120	120	120	98 UJ	20400 U	5000	2000 U	16000 U
surface	Bis(2-chloro-1-methylethyl) ether	(ug/kg)	5	0	0						19 UJ	20 U	19.2	19 U	19 U
surface	2,4-Dinitrotoluene	(ug/kg)	11	0	0						96 U	20400 U	3760	500 U	10000 U
surface	2,6-Dinitrotoluene	(ug/kg)	11	0	0						96 U	5100 U	1280	500 U	4000 U
surface	2-Chloronaphthalene	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	2-Nitroaniline	(ug/kg)	11	0	0						96 U	3370 U	861	330 U	2640 U
surface	3,3'-Dichlorobenzidine	(ug/kg)	11	0	0						96 U	10200 U	2520	1000 U	8000 U
surface	3-Nitroaniline	(ug/kg)	11	0	0						120 U	10200 U	2530	1000 U	8000 U
surface	4-Bromophenyl phenyl ether	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	4-Chloroaniline	(ug/kg)	11	0	0						58 U	20400 U	4970	2000 U	16000 U
surface	4-Chlorophenyl phenyl ether	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	4-Nitroaniline	(ug/kg)	11	0	0						96 U	3370 U	861	330 U	2640 U
surface	Benzoic acid	(ug/kg)	11	0	0						190 U	10200 U	2560	1000 U	8000 U
surface	Benzyl alcohol	(ug/kg)	11	0	0						19 UJ	3370 U	825	330 U	2640 U
surface	Bis(2-chloroethoxy) methane	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	Bis(2-chloroethyl) ether	(ug/kg)	11	0	0						38 U	3370 U	834	330 U	2640 U
surface	Carbazole	(ug/kg)	5	1	20	180 J	180 J	180	180 J	180 J	19 UJ	180 J	51.4	19 UJ	20 UJ
surface	Dibenzofuran	(ug/kg)	11	1	9.09	48	48	48	48	48	19 U	3370 U	828	330 U	2640 U
surface	Hexachlorobenzene	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	Hexachlorobutadiene	(ug/kg)	11	0	0						19 U	10200 U	2480	1000 U	8000 U
surface	Hexachlorocyclopentadiene	(ug/kg)	11	0	0						96 U	10200 U	2520	1000 U	8000 U
surface	Hexachloroethane	(ug/kg)	11	0	0						19 U	10200 U	2480	1000 U	8000 U
surface	Isophorone	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	Nitrobenzene	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	N-Nitrosodipropylamine	(ug/kg)	11	0	0						38 U	3370 U	834	330 U	2640 U
surface	N-Nitrosodiphenylamine	(ug/kg)	11	0	0						19 U	3370 U	825	330 U	2640 U
surface	Bis(2-chloroisopropyl) ether	(ug/kg)	6	0	0						330 U	3370 U	1500	660 U	2640 U
surface	1,1,1,2-Tetrachloroethane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,1,1-Trichloroethane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,1,2,2-Tetrachloroethane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,1,2-Trichloroethane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,1-Dichloroethane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Vinylidene chloride	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,2,3-Trichloropropane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,2-Dichloroethane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,2-Dichloropropane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Methylethyl ketone	(ug/kg)	4	0	0						2500 U	5100 U	3150	2500 U	2500 U
surface	Methyl N-butyl ketone	(ug/kg)	4	0	0						1000 U	2040 U	1260	1000 U	1000 U
surface	Methyl isobutyl ketone	(ug/kg)	4	0	0						500 U	1020 U	630	500 U	500 U
surface	Acetone	(ug/kg)	4	0	0						2500 U	5100 U	3150	2500 U	2500 U
surface	Benzene	(ug/kg)	6	0	0						50 U	204 U	101	100 U	100 U
surface	Bromochloromethane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Bromodichloromethane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Bromoform	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Bromomethane	(ug/kg)	4	0	0						1000 U	2040 U	1260	1000 U	1000 U
surface	Carbon disulfide	(ug/kg)	4	0	0						1000 U	2040 U	1260	1000 U	1000 U
surface	Carbon tetrachloride	(ug/kg)	4	0	0						200 U	408 U	252	200 U	200 U
surface	Chlorodibromomethane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Chloroethane	(ug/kg)	4	0	0						200 U	408 U	252	200 U	200 U
surface	Chloroform	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Chloromethane	(ug/kg)	4	0	0						500 U	1020 U	630	500 U	500 U
surface	cis-1,3-Dichloropropene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Methylene bromide	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Dichlorodifluoromethane	(ug/kg)	4	0	0						500 U	1020 U	630	500 U	500 U
surface	Ethylbenzene	(ug/kg)	6	0	0						50 U	204 U	101	100 U	100 U
surface	Isopropylbenzene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	m,p-Xylene	(ug/kg)	4	0	0						200 U	408 U	252	200 U	200 U
surface	Methylene chloride	(ug/kg)	4	0	0						500 U	1020 U	630	500 U	500 U
surface	o-Xylene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Styrene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Tetrachloroethene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Toluene	(ug/kg)	6	2	33.3	50 J	50 J	50	50 J	50 J	50 J	204 U	101	100 U	100 U
surface	trans-1,2-Dichloroethene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	trans-1,3-Dichloropropene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Trichloroethene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Trichlorofluoromethane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Vinyl chloride	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,1-Dichloropropene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,2-Dibromo-3-chloropropane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,3,5-Trimethylbenzene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,3-Dichloropropane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	2,2-Dichloropropane	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	2-Chlorotoluene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	4-Chlorotoluene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Bromobenzene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	cis-1,2-Dichloroethene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Ethylene dibromide	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	n-Butylbenzene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	n-Propylbenzene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	p-Cymene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Pseudocumene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Sec-butylbenzene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	tert-Butylbenzene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	Xylene	(ug/kg)	2	2	100	50 J	50 J	50	50 J	50 J	50 J	50 J	50	50 J	50 J
surface	Chlorobenzene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,2-Dichlorobenzene	(ug/kg)	11	0	0						19 U	8000 U	873	100 U	1000 U
surface	1,3-Dichlorobenzene	(ug/kg)	11	0	0						19 U	8000 U	873	100 U	1000 U
surface	1,4-Dichlorobenzene	(ug/kg)	11	0	0						19 U	8000 U	873	100 U	1000 U
surface	1,2,3-Trichlorobenzene	(ug/kg)	4	0	0						100 U	204 U	126	100 U	100 U
surface	1,2,4-Trichlorobenzene	(ug/kg)	11	0	0						19 U	2640 U	325	100 U	330 U
subsurface	Aroclor 1016	(ug/kg)	4	0	0						67 U	144 U	86.3	67 U	67 U
subsurface	Aroclor 1242	(ug/kg)	4	0	0						67 U	144 U	86.3	67 U	67 U
subsurface	Aroclor 1248	(ug/kg)	4	0	0						67 U	144 U	86.3	67 U	67 U
subsurface	Aroclor 1254	(ug/kg)	4	2	50	85.9	194	140	85.9	85.9	67 U	194	123	85.9	144 U
subsurface	Aroclor 1260	(ug/kg)	4	0	0						67 U	144 U	86.3	67 U	67 U
subsurface	Aroclor 1221	(ug/kg)	4	0	0						134 U	288 U	173	134 U	137 U
subsurface	Aroclor 1232	(ug/kg)	4	0	0						67 U	144 U	86.3	67 U	67 U
subsurface	Polychlorinated biphenyl	(ug/kg)	4	2	50	85.9 A	194 A	140	85.9 A	85.9 A	85.9 A	288 UA	176	137 UA	194 A
subsurface	Total solids	(%)	4	4	100	46.5	67.9	56.6	50.8	61	46.5	67.9	56.6	50.8	61
subsurface	Total organic carbon	(%)	6	6	100	0.255	2.6	1.34	0.82	2.4	0.255	2.6	1.34	0.82	2.4
subsurface	Total volatile solids	(%)	1	1	100	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
subsurface	Bromine	(ug/kg)	1	1	100	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
subsurface	Chlorine	(ug/kg)	1	1	100	610	610	610	610	610	610	610	610	610	610
subsurface	Ammonia	(mg/kg)	4	4	100	45.9	207	126	110	142	45.9	207	126	110	142
subsurface	2,3,7,8-Tetrachlorodibenzo-p-dioxin	(ng/kg)	1	0	0						0.58 U	0.58 U	0.58	0.58 U	0.58 U
subsurface	Tetrachlorodibenzo-p-dioxin	(ng/kg)	1	1	100	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
subsurface	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	(ng/kg)	1	0	0						1.5 U	1.5 U	1.5	1.5 U	1.5 U
subsurface	Pentachlorodibenzo-p-dioxin	(ng/kg)	1	0	0						1.5 U	1.5 U	1.5	1.5 U	1.5 U
subsurface	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	(ng/kg)	1	1	100	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
subsurface	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	(ng/kg)	1	1	100	21	21	21	21	21	21	21	21	21	21
subsurface	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	(ng/kg)	1	1	100	11	11	11	11	11	11	11	11	11	11
subsurface	Hexachlorodibenzo-p-dioxin	(ng/kg)	1	1	100	140	140	140	140	140	140	140	140	140	140
subsurface	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	(ng/kg)	1	1	100	380	380	380	380	380	380	380	380	380	380
subsurface	Heptachlorodibenzo-p-dioxin	(ng/kg)	1	1	100	710	710	710	710	710	710	710	710	710	710
subsurface	Octachlorodibenzo-p-dioxin	(ng/kg)	1	1	100	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700
subsurface	2,3,7,8-Tetrachlorodibenzofuran	(ng/kg)	1	1	100	19	19	19	19	19	19	19	19	19	19
subsurface	Tetrachlorodibenzofuran	(ng/kg)	1	1	100	49	49	49	49	49	49	49	49	49	49
subsurface	1,2,3,7,8-Pentachlorodibenzofuran	(ng/kg)	1	1	100	24	24	24	24	24	24	24	24	24	24
subsurface	2,3,4,7,8-Pentachlorodibenzofuran	(ng/kg)	1	1	100	10	10	10	10	10	10	10	10	10	10
subsurface	Pentachlorodibenzofuran	(ng/kg)	1	1	100	84	84	84	84	84	84	84	84	84	84
subsurface	1,2,3,4,7,8-Hexachlorodibenzofuran	(ng/kg)	1	0	0						62 U	62 U	62	62 U	62 U
subsurface	1,2,3,6,7,8-Hexachlorodibenzofuran	(ng/kg)	1	1	100	11	11	11	11	11	11	11	11	11	11
subsurface	1,2,3,7,8,9-Hexachlorodibenzofuran	(ng/kg)	1	1	100	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
subsurface	2,3,4,6,7,8-Hexachlorodibenzofuran	(ng/kg)	1	1	100	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
subsurface	Hexachlorodibenzofuran	(ng/kg)	1	1	100	140	140	140	140	140	140	140	140	140	140
subsurface	1,2,3,4,6,7,8-Heptachlorodibenzofuran	(ng/kg)	1	1	100	67	67	67	67	67	67	67	67	67	67
subsurface	1,2,3,4,7,8,9-Heptachlorodibenzofuran	(ng/kg)	1	1	100	12	12	12	12	12	12	12	12	12	12
subsurface	Heptachlorodibenzofuran	(ng/kg)	1	1	100	260	260	260	260	260	260	260	260	260	260
subsurface	Octachlorodibenzofuran	(ng/kg)	1	1	100	230	230	230	230	230	230	230	230	230	230
subsurface	Gravel	(%)	1	1	100	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
subsurface	Sand	(%)	2	2	100	24.6	32.23	28.4	24.6	24.6	24.6	32.23	28.4	24.6	24.6
subsurface	Fines	(%)	2	2	100	67.22	75.4	71.3	67.22	67.22	67.22	75.4	71.3	67.22	67.22
subsurface	Silt	(%)	2	2	100	53.71	62.4	58.1	53.71	53.71	53.71	62.4	58.1	53.71	53.71
subsurface	Coarse silt	(%)	4	4	100	10.7	33.2	23.8	18.4	33	10.7	33.2	23.8	18.4	33
subsurface	Medium silt	(%)	4	4	100		13.6	5.1		6.8	0	13.6	5.1	0	6.8
subsurface	Fine silt	(%)	4	4	100		7.4	5.25	6.8	6.8	0	7.4	5.25	6.8	6.8
subsurface	Very fine silt	(%)	4	4	100		6.8	3.4		6.8	0	6.8	3.4	0	6.8
subsurface	Clay	(%)	2	2	100	13	13.51	13.3	13	13	13	13.51	13.3	13	13
subsurface	8-9 Phi clay	(%)	4	4	100		6.8	2.63		3.7	0	6.8	2.63	0	3.7
subsurface	9-10 Phi clay	(%)	4	4	100		6.8	2.63		3.7	0	6.8	2.63	0	3.7
subsurface	>10 Phi clay	(%)	4	4	100		6.8	1.7			0	6.8	1.7	0	0
subsurface	Mean grain size	(%)	1	1	100	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049
subsurface	Median grain size	(%)	1	1	100	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023
subsurface	Sieve 4	(%)	4	4	100		6	1.55		0.2	0	6	1.55	0	0.2
subsurface	Sieve 10	(%)	4	4	100		1.1	0.45	0.3	0.4	0	1.1	0.45	0.3	0.4
subsurface	Sieve 20	(%)	4	4	100	0.2	0.4	0.325	0.3	0.4	0.2	0.4	0.325	0.3	0.4
subsurface	Sieve 40	(%)	4	4	100	0.5	1.6	0.8	0.5	0.6	0.5	1.6	0.8	0.5	0.6
subsurface	Sieve 60	(%)	4	4	100	0.7	10.7	3.9	1.9	2.3	0.7	10.7	3.9	1.9	2.3
subsurface	Sieve 140	(%)	4	4	100	3	51.7	24.2	14.4	27.7	3	51.7	24.2	14.4	27.7
subsurface	Sieve 200	(%)	4	4	100	0.6	5.6	3.03	0.7	5.2	0.6	5.6	3.03	0.7	5.2
subsurface	Sieve 230	(%)	4	4	100	5.6	21.9	12.5	6.8	15.5	5.6	21.9	12.5	6.8	15.5
subsurface	Aluminum	(mg/kg)	1	1	100	37100	37100	37100	37100	37100	37100	37100	37100	37100	37100

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Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
subsurface	Antimony	(mg/kg)	1	0	0						5 UJ	5 UJ	5	5 UJ	5 UJ
subsurface	Arsenic	(mg/kg)	5	4	80	3.61	6.62	4.82	4.5	4.54	3.61	6.62	4.85	4.54	5 U
subsurface	Cadmium	(mg/kg)	5	1	20	0.4	0.4	0.4	0.4	0.4	0.4	1.08 U	0.596	0.5 U	0.5 U
subsurface	Chromium	(mg/kg)	5	5	100	27.8	36.8	32.1	31.4	35.2	27.8	36.8	32.1	31.4	35.2
subsurface	Copper	(mg/kg)	5	5	100	26.8	40.9	35.5	35.8	38.4	26.8	40.9	35.5	35.8	38.4
subsurface	Lead	(mg/kg)	5	5	100	17.8	47	32.5	34	36.5	17.8	47	32.5	34	36.5
subsurface	Manganese	(mg/kg)	1	1	100	529	529	529	529	529	529	529	529	529	529
subsurface	Mercury	(mg/kg)	5	5	100	0.11	0.333	0.21	0.205	0.254	0.11	0.333	0.21	0.205	0.254
subsurface	Nickel	(mg/kg)	1	1	100	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4
subsurface	Selenium	(mg/kg)	5	2	40	0.939	9	4.97	0.939	0.939	0.5 U	9	2.4	0.939	1.08 U
subsurface	Silver	(mg/kg)	5	2	40	1.06	1.2	1.13	1.06	1.06	1 U	2.15 U	1.28	1.06	1.2
subsurface	Thallium	(mg/kg)	1	0	0						5 U	5 U	5	5 U	5 U
subsurface	Zinc	(mg/kg)	5	5	100	69.8	164	125	125	143	69.8	164	125	125	143
subsurface	Barium	(mg/kg)	5	5	100	129	197	163	172	175	129	197	163	172	175
subsurface	Beryllium	(mg/kg)	1	1	100	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
subsurface	Calcium	(mg/kg)	1	1	100	7490	7490	7490	7490	7490	7490	7490	7490	7490	7490
subsurface	Cobalt	(mg/kg)	1	1	100	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
subsurface	Iron	(mg/kg)	1	1	100	40200	40200	40200	40200	40200	40200	40200	40200	40200	40200
subsurface	Magnesium	(mg/kg)	1	1	100	6510	6510	6510	6510	6510	6510	6510	6510	6510	6510
subsurface	Potassium	(mg/kg)	1	1	100	1330	1330	1330	1330	1330	1330	1330	1330	1330	1330
subsurface	Sodium	(mg/kg)	1	1	100	1060 J	1060 J	1060	1060 J	1060 J	1060 J	1060 J	1060	1060 J	1060 J
subsurface	Vanadium	(mg/kg)	1	1	100	98.2	98.2	98.2	98.2	98.2	98.2	98.2	98.2	98.2	98.2
subsurface	2-Methylnaphthalene	(ug/kg)	5	1	20	730	730	730	730	730	330 U	3550 U	1380	730	1650 U
subsurface	Acenaphthene	(ug/kg)	5	1	20	2500	2500	2500	2500	2500	330 U	3550 U	1740	1650 U	2500
subsurface	Acenaphthylene	(ug/kg)	5	1	20	220	220	220	220	220	220	3550 U	1280	660 U	1650 U
subsurface	Anthracene	(ug/kg)	5	1	20	1800	1800	1800	1800	1800	330 U	3550 U	1600	1650 U	1800
subsurface	Fluorene	(ug/kg)	5	1	20	1700	1700	1700	1700	1700	330 U	3550 U	1580	1650 U	1700
subsurface	Naphthalene	(ug/kg)	5	1	20	1500	1500	1500	1500	1500	330 U	3550 U	1540	1500	1650 U
subsurface	Phenanthrene	(ug/kg)	5	3	60	1290	16000	6320	1670	1670	330 U	16000	4570	1670	3550 U
subsurface	Low Molecular Weight PAH	(ug/kg)	5	3	60	1290 A	23720 A	8890	1670 A	1670 A	330 UA	23720 A	6110	1670 A	3550 UA
subsurface	Dibenz(a,h)anthracene	(ug/kg)	5	1	20	680	680	680	680	680	330 U	3550 U	1370	680	1650 U
subsurface	Benz(a)anthracene	(ug/kg)	5	1	20	2400	2400	2400	2400	2400	330 U	3550 U	1720	1650 U	2400
subsurface	Benzo(a)pyrene	(ug/kg)	5	1	20	3500	3500	3500	3500	3500	330 U	3550 U	1940	1650 U	3500
subsurface	Benzo(b)fluoranthene	(ug/kg)	5	1	20	1800	1800	1800	1800	1800	330 U	3550 U	1600	1650 U	1800
subsurface	Benzo(g,h,i)perylene	(ug/kg)	5	1	20	3300	3300	3300	3300	3300	330 U	3550 U	1900	1650 U	3300
subsurface	Benzo(k)fluoranthene	(ug/kg)	5	1	20	2100	2100	2100	2100	2100	330 U	3550 U	1660	1650 U	2100
subsurface	Chrysene	(ug/kg)	5	1	20	3300	3300	3300	3300	3300	330 U	3550 U	1900	1650 U	3300
subsurface	Fluoranthene	(ug/kg)	5	2	40	1270	11000	6140	1270	1270	330 U	11000	3560	1650 U	3550 U
subsurface	Indeno(1,2,3-cd)pyrene	(ug/kg)	5	1	20	2500	2500	2500	2500	2500	330 U	3550 U	1740	1650 U	2500
subsurface	Pyrene	(ug/kg)	5	3	60	1480	15000	6110	1840	1840	330 U	15000	4440	1840	3550 U
subsurface	Benzo(b+k)fluoranthene	(ug/kg)	5	1	20	3900 A	3900 A	3900	3900 A	3900 A	330 UA	3900 A	2020	1650 UA	3550 UA
subsurface	High Molecular Weight PAH	(ug/kg)	5	3	60	1840 A	45580 A	16700	2750 A	2750 A	330 UA	45580 A	10800	2750 A	3550 UA
subsurface	Polycyclic Aromatic Hydrocarbons	(ug/kg)	5	3	60	3510 A	69300 A	25600	4040 A	4040 A	330 UA	69300 A	16100	3550 UA	4040 A
subsurface	4,4'-DDD	(ug/kg)	4	2	50	19.2	32	25.6	19.2	19.2	6.7 U	43.3 U	25.3	19.2	32
subsurface	4,4'-DDE	(ug/kg)	4	1	25	13.9	13.9	13.9	13.9	13.9	6.7 U	43.3 U	21	13.9	20.1 U
subsurface	4,4'-DDT	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	Total of 3 isomers: pp-DDT,-DDD,-DDE	(ug/kg)	4	2	50	32 A	33.1 A	32.6	32 A	32 A	6.7 UA	43.3 UA	28.8	32 A	33.1 A
subsurface	Aldrin	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	alpha-Hexachlorocyclohexane	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	beta-Hexachlorocyclohexane	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	delta-Hexachlorocyclohexane	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Detected Concentrations Maximum	Detected Concentrations Mean	Detected Concentrations Median	Detected Concentrations 95th	Detected and Nondetected Concentrations Minimum	Detected and Nondetected Concentrations Maximum	Detected and Nondetected Concentrations Mean	Detected and Nondetected Concentrations Median	Detected and Nondetected Concentrations 95th
subsurface	gamma-Hexachlorocyclohexane	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	cis-Chlordane	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	trans-Chlordane	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	Dieldrin	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	alpha-Endosulfan	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	beta-Endosulfan	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	Endosulfan sulfate	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	Endrin	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	Endrin aldehyde	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	Endrin ketone	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	Heptachlor	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	Heptachlor epoxide	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	Methoxychlor	(ug/kg)	4	0	0						6.7 U	43.3 U	19.2	6.7 U	20.1 U
subsurface	Toxaphene	(ug/kg)	4	0	0						200 U	1290 U	573	200 U	600 U
subsurface	Chlordane (technical)	(ug/kg)	4	0	0						150 U	968 U	430	150 U	450 U
subsurface	2,4,5-Trichlorophenol	(ug/kg)	5	0	0						170 U	3550 U	1270	660 U	1650 U
subsurface	2,4,6-Trichlorophenol	(ug/kg)	5	0	0						170 U	3550 U	1270	660 U	1650 U
subsurface	2,4-Dichlorophenol	(ug/kg)	5	0	0						100 U	3550 U	1260	660 U	1650 U
subsurface	2,4-Dimethylphenol	(ug/kg)	5	0	0						35 U	10800 U	3770	2000 U	5000 U
subsurface	2,4-Dinitrophenol	(ug/kg)	5	0	0						330 U	3550 U	1310	660 U	1650 U
subsurface	2-Chlorophenol	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	2-Methylphenol	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	2-Nitrophenol	(ug/kg)	5	0	0						170 U	3550 U	1270	660 U	1650 U
subsurface	4,6-Dinitro-2-methylphenol	(ug/kg)	5	0	0						350 UJ	10800 U	3830	2000 U	5000 U
subsurface	4-Chloro-3-methylphenol	(ug/kg)	5	0	0						69 U	3550 U	1250	660 U	1650 U
subsurface	4-Methylphenol	(ug/kg)	1	1	100	280	280	280	280	280	280	280	280	280	280
subsurface	4-Nitrophenol	(ug/kg)	5	0	0						170 U	10800 U	3790	2000 U	5000 U
subsurface	Pentachlorophenol	(ug/kg)	5	0	0						170 UJ	10800 U	3790	2000 U	5000 U
subsurface	Phenol	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	3- and 4-Methylphenol Coelution	(ug/kg)	4	0	0						330 U	3550 U	1550	660 U	1650 U
subsurface	Dimethyl phthalate	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	Diethyl phthalate	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	Dibutyl phthalate	(ug/kg)	5	0	0						35 U	10800 U	3770	2000 U	5000 U
subsurface	Butylbenzyl phthalate	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	Di-n-octyl phthalate	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	Bis(2-ethylhexyl) phthalate	(ug/kg)	5	1	20	120	120	120	120	120	120	21500 U	7520	4000 U	10000 U
subsurface	Bis(2-chloro-1-methylethyl) ether	(ug/kg)	1	0	0						35 U	35 U	35	35 U	35 U
subsurface	2,4-Dinitrotoluene	(ug/kg)	5	0	0						170 U	21500 U	7530	4000 U	10000 U
subsurface	2,6-Dinitrotoluene	(ug/kg)	5	0	0						170 U	5380 U	1910	1000 U	2500 U
subsurface	2-Chloronaphthalene	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	2-Nitroaniline	(ug/kg)	5	0	0						170 U	3550 U	1270	660 U	1650 U
subsurface	3,3'-Dichlorobenzidine	(ug/kg)	5	0	0						170 U	10800 U	3790	2000 U	5000 U
subsurface	3-Nitroaniline	(ug/kg)	5	0	0						210 UJ	10800 U	3800	2000 U	5000 U
subsurface	4-Bromophenyl phenyl ether	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	4-Chloroaniline	(ug/kg)	5	0	0						100 U	21500 U	7520	4000 U	10000 U
subsurface	4-Chlorophenyl phenyl ether	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	4-Nitroaniline	(ug/kg)	5	0	0						170 UJ	3550 U	1270	660 U	1650 U
subsurface	Benzoic acid	(ug/kg)	5	0	0						350 U	10800 U	3830	2000 U	5000 U
subsurface	Benzyl alcohol	(ug/kg)	5	0	0						35 UJ	3550 U	1250	660 U	1650 U
subsurface	Bis(2-chloroethoxy) methane	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	Bis(2-chloroethyl) ether	(ug/kg)	5	0	0						69 U	3550 U	1250	660 U	1650 U

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This document is currently under review by US EPA and its federal, state and tribal partners, and is subject to change in whole or part

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
subsurface	Carbazole	(ug/kg)	1	1	100	310 J	310 J	310	310 J	310 J	310 J	310 J	310	310 J	310 J
subsurface	Dibenzofuran	(ug/kg)	5	1	20	220	220	220	220	220	220	3550 U	1280	660 U	1650 U
subsurface	Hexachlorobenzene	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	Hexachlorobutadiene	(ug/kg)	5	0	0						35 U	10800 U	3770	2000 U	5000 U
subsurface	Hexachlorocyclopentadiene	(ug/kg)	5	0	0						170 UJ	10800 U	3790	2000 U	5000 U
subsurface	Hexachloroethane	(ug/kg)	5	0	0						35 U	10800 U	3770	2000 U	5000 U
subsurface	Isophorone	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	Nitrobenzene	(ug/kg)	5	0	0						35 U	3550 U	1250	660 U	1650 U
subsurface	N-Nitrosodipropylamine	(ug/kg)	5	0	0						69 U	3550 U	1250	660 U	1650 U
subsurface	N-Nitrosodiphenylamine	(ug/kg)	5	0	0						35 UJ	3550 U	1250	660 U	1650 U
subsurface	Bis(2-chloroisopropyl) ether	(ug/kg)	4	0	0						330 U	3550 U	1550	660 U	1650 U
subsurface	1,2-Dichlorobenzene	(ug/kg)	1	0	0						35 U	35 U	35	35 U	35 U
subsurface	1,3-Dichlorobenzene	(ug/kg)	1	0	0						35 U	35 U	35	35 U	35 U
subsurface	1,4-Dichlorobenzene	(ug/kg)	1	0	0						35 U	35 U	35	35 U	35 U
subsurface	1,2,4-Trichlorobenzene	(ug/kg)	1	0	0						35 U	35 U	35	35 U	35 U

SUPPLEMENTAL FIGURES

Figure 1. Site Location Map (Delta)

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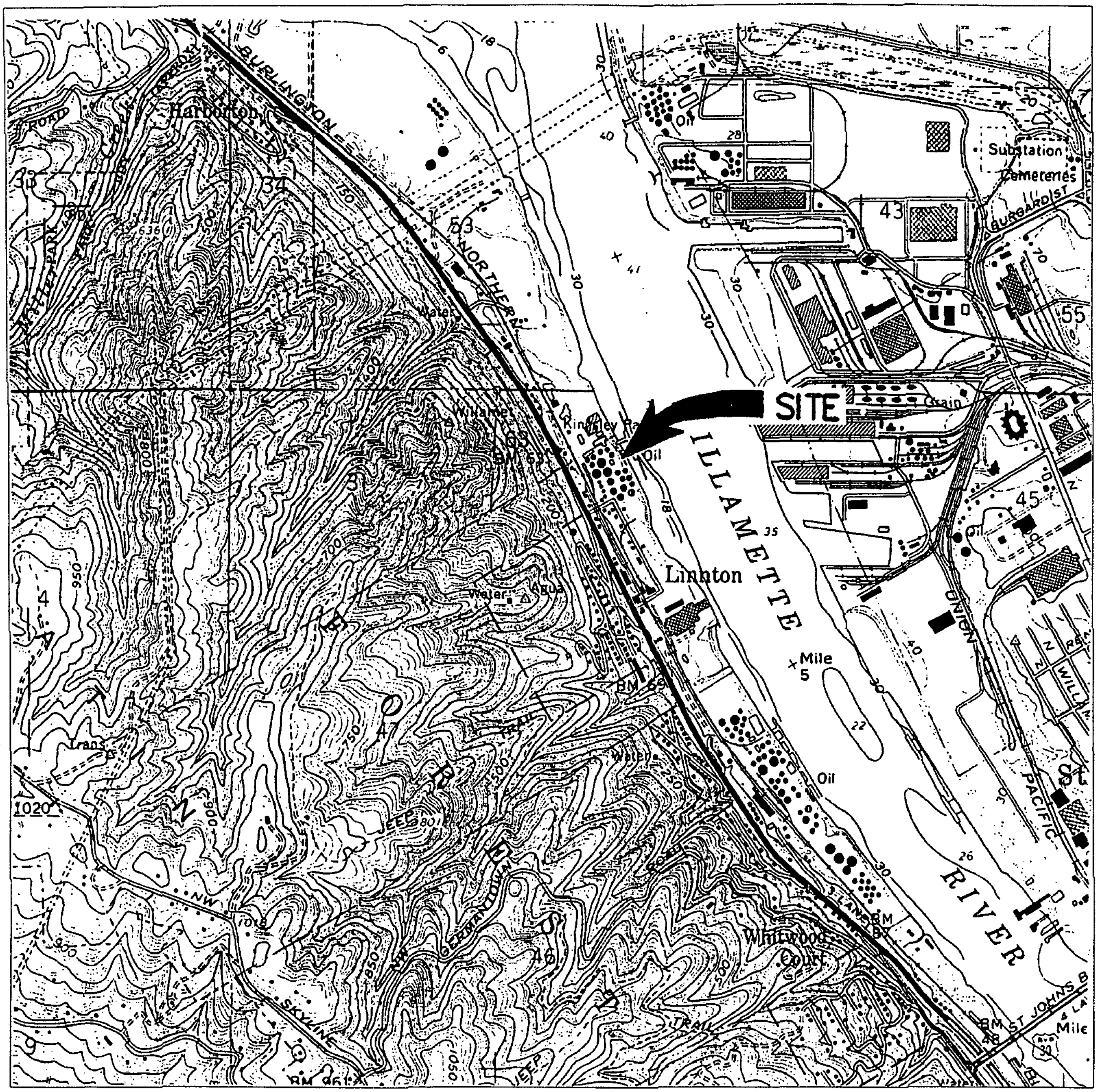
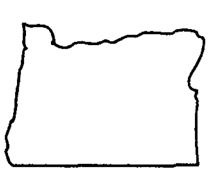


REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC MAP
LINNTON, OREGON, 1961
PHOTOREVISED 1984

SCALE 1 : 25,000



QUADRANGLE LOCATION

FIGURE 1

SITE LOCATION MAP

Kinder Morgan Liquid Terminals LLC
Linnton Terminal
11400 NW St. Helens Road
Portland, Oregon

PROJECT NO. PTKM-01L-1	DRAWN BY CRF	Delta Environmental Consultants, Inc.
FILE NO.	PREPARED BY CRF	
REVISION NO.	REVIEWED BY	

Appendix A-8

Mar Com

MAR COM INC. SHIPYARD
CSM Site Summary – Appendix A-8

MAR COM INC. SHIPYARD

Oregon DEQ ECSI #: 2350

8970 N. Bradford Street
Portland, OR 97203

DEQ Site Mgr: Alicia Voss
Latitude: 45.589°
Longitude: -122.764°
Township/Range/Section: 1N/1W/12

River Mile: 5.6 East bank

LWG Member ☐ Yes ☒ No

Upland Analytical Data Status: ☐ Electronic Data Available ☒ Hardcopies only

1. SUMMARY OF POTENTIAL CONTAMINANT TRANSPORT PATHWAYS TO THE RIVER

The current understanding of the transport mechanism of contaminants from the uplands portions of the Mar Com site to the river is summarized in this section and Table 1, and supported in following sections.

1.1. Overland Transport

North Parcel[1]

Generally, overland transport of contaminants to the river from soil erosion is expected to be slight from the North Parcel with the exception of transport from the parcel's southwest corner and areas surrounding the Quonset Hut. Once the remedial activities have been completed in these areas of the Mar Com site, including removal of spent grit piles and disposal of excavated impacted soils, the potential for contaminants to be released by overland flow will be alleviated (Parametrix 2002a).

South Parcel

There is potential for overland transport of contaminants to the river in the South Parcel due to soil erosion, which, in general, is caused by the movement of ships/barges on and off the southern parcel's uplands. The parcel's naturally sloping topography toward the river, shipway areas, and the lack of containment walls, silt screening structures, or berms on the uplands provides the means for the transport of contaminants associated with the spent grit, slag, and exposed stained soil areas defined in Section 10.1. In fact, the southern parcel's runoff is directed into three drainage basin areas, of which two basins discharge directly into the river (i.e., ship repair uplands associated with slipways 1 and 2). Runoff from the third drainage area (uplands adjacent to the east property line) is transported into the oil/water separator plant before being discharged to river (Parametrix 2002a).

[1] The XPA report refers to the North and South parcels while discussing the environmental assessment data. The parcel designations generally coincide with the City of Portland stormwater drainage easement that passes through the property from east to west, bisecting the property into the North and South Parcels.

1.2. *Riverbank Erosion*

The facility's sloped riverbank consists alternatively of vegetation and exposed soils. Riverbank erosion is exacerbated by the positioning of vessels for transportation on and off the slipways located on the shoreline. A small area of soil contamination, primarily petroleum hydrocarbons, had been detected close to the riverbank. According to DEQ (2003), this area may have some erosion potential.

1.3. *Groundwater*

Shallow groundwater from the site discharges to the Willamette River. The DEQ has concluded that the extent of contamination in the North Parcel had been adequately investigated and that the groundwater beneath the North Parcel does not pose an unacceptable risk to the Willamette River (DEQ 2003). Additional investigation is needed to understand groundwater conditions beneath the South Parcel.

To date, no information has been presented regarding the depths of the three storm sewer utilities beneath the South Parcel relative to the groundwater table or if they may be considered a groundwater preferential pathway at the site.

1.4. *Direct Discharge (Overwater Activities and Stormwater/Wastewater Systems)*

North Parcel

The City's stormwater outfall (OF52A), located at the edge of the gulch (southeast corner of parcel), drains through the North Parcel. Outfall WR-286 was identified in 1999 during the City's outfall survey, but could not be located by DEQ in 2004.

There is one floating dry dock that is connected by support structures (gangway and dock) located off shore of the North Parcel's uplands. Ship repair and maintenance activities at the dry dock and support structures may contribute contaminants related to ship repair and maintenance activities that could be discharged to the river (DEQ 2003, pers. comm.).

South Parcel

There are two private outfalls located along the southern parcel's shoreline. Although both stormwater systems receive contaminants related to onsite industrial practices, only the stormwater runoff from the area adjacent to the eastern property boundary is transported to the oil/water separator plant before being discharged to the river. There is also a channelized stormwater drainage at the shipway skids that discharges to the river.

1.5. *Relationship of Upland Sources to River Sediments*

See Final CSM Update.

1.6. *Sediment Transport*

The Mar Com facility is located near the center of a relatively narrow stretch of the river (RM 5-7) that is characterized as a transport/non-depositional zone based on the site physical information compiled in the Programmatic Work Plan (Integral et al. 2004). The Sediment Trend Analysis® results indicate that sediment movement here is in dynamic equilibrium (i.e., surface sediments are scoured from and deposited in this area without net erosion or accretion). The time-series bathymetric change data over the 25-month period from January 2002 through February 2004 shows areas of no change interspersed with areas of small-scale net erosion (up to 1 foot) just offshore and in the main channel adjacent to the property (Integral and DEA in prep.). Due to limited survey vessel access, no sediment transport information is available for the nearshore immediately surrounding the Mar Com boat launch area.

2. CSM SITE SUMMARY REVISIONS

Date of Last Revision: September 17, 2004

3. PROJECT STATUS

Activity		Date(s)/Comments
PA/XPA	☒	2002/COPCs were detected in soil, grit, slag, groundwater, and sediment samples.
RI	☒	2003/DEQ determined that removing spent grit and impacted soils located in the SW corner of the North Parcel was adequate remedial action for eliminating human health and environmental exposures.
FS	☐	
Interim Action/Source Control	☒	Source Control Decision for North Parcel (DEQ 2003)
ROD	☒	ROD for North Parcel (DEQ, May 2004)
RD/RA	☐	
NFA	☐	

A prospective purchasers agreement is under negotiation stating the intended use for the North Parcel is an extension of the Port of Portland Terminal 4 auto storage yard (DEQ 2004).

DEQ Portland Harbor Site Ranking (Tier 1, 2, or 3): 1

4. SITE OWNER HISTORY

Sources: DEQ 1999, 2003; Polk City of Portland directories; Sanborn fire insurance maps, USACE Port Series reports, hydrographic charts and aerial photographs; Parametrix 2002a

Owner/Occupant	Type of Operation	Years
Langley-St. Johns Partnership - **Owner**	Unknown	? - present
Mar Com Inc. – **Owner**	Ship repair	1995 - ?
C & L Sandblasting and Painting	Sandblasting and painting	2000 - ?
Marine Ways Corp/ Mar Com Marine Ways	Unknown	1995 - 1996
Mar Com, Inc.	Sandblasting and painting	1969 - 1995
Other occupants include: Marine Repair Co., M&L Lumber Co., Port Services, Riverside Lumber, Sauvie Island Truck Service, International Paper Co., C's Shop (vehicle maintenance), Independent Marine Propeller Shop.	Unknown	Years of occupancy are unknown
Light Rock Dock	Concrete work	1992 - 1995
Nickels Marine Ways, Inc.	Mooring vessels awaiting repair	1991 - ?
Marine Machine Works	Unknown	1986 - ?

Owner/Occupant	Type of Operation	Years
EMC Industries	Sales and manufacture of wood products	1986 - ?
JDAC, Inc.	Electrical services	1986 - ?
L&S Marine, Inc.	Mooring vessels awaiting repair	1985 - ?
Marine Machine Works	Machine shop	1980 - ?
St. Johns Forest Products Co.	Stud mill	1979 - 1986
Starmaster Trophies	Unknown	1969 - ?
Room-A-Rama, Inc.	Furniture manufacturing	1965 - ?
Ray Osolin - **Owner**	?	1962 to ?
Floating Marine Ways	Boat builders and repair company	1962 - 1976
Estates of William Barker & S.B. Stewart- **Owner**	?	1932 to ?
Weyerhauser Lumber Company - **Owner**	?	1932 to ?
Independent Marine Propeller	Shop	1950 – 1960?
Erion Lumber and Fuel Co.	Saw mill	1949 - 1979
Kern & Kibbe/Kern & Kibbe-McKinnon	Building contractors	1945 - ?
Portland Woolen Mills (SE corner)	Woolen company	1924 - ?
Shaver Transportation	Mooring company-owned floating equipment and storage	1925 - ?
U.S. Shipping Board, Emergency Fleet Corp. (North of upland shipways)	Shipyard, marine ways, and storage yard	1920 - ?
Grant Smith-Porter Ship Company	Shipyard and marine ways	? - 1924
Grant Smith-Porter-Guthrie Co.	Shipyard and marine ways	1917 - ?

5. PROPERTY DESCRIPTION

The Mar Com Ship Repair facility is approximately 600 feet downstream from the St. Johns Bridge, and is located along the northeast bank of the Willamette River at approximately RM 5.6 (Figure 1). The approximate 15.5-acre property is zoned for heavy industrial and manufacturing uses and is encircled by residences to the east, the City's Cathedral Park to the south, and Toyota's off-loading storage yard to the west (leased from Port of Portland). The site shares its upstream property line with Cathedral Park. The South Parcel gently slopes to the river's shoreline; the North Parcel is relatively flat and its eastern half slopes to the east. Based on historical aerial photos observed by Integral, surficial soils are composed entirely of fill materials. In fact, the southwest corner of the site is referred to as the "knoll" because materials dredged from the shipway in 1987 were placed on top of pre-existing soils (Parametrix 2002a).

The locations of water and sanitary sewer utilities are included on Supplemental Figure 3 from Parametrix (2002a). A water line lies beneath N. Bradford Street. Water to the property is provided by a connection to the administrative office and is distributed across the property. The sewer line courses southward under N Bradford Street, which also services Mar Com's administrative office.

Mar Com leases four submerged areas from the Oregon Department of State Lands, as shown in the Supplemental Figure, Exhibit A.

This document currently under review by US EPA and its federal, state and tribal partners, and is subject to change in whole or part..

North Parcel

The North Parcel, divided from the South Parcel by the City's stormwater drainage easement, is approximately 10.5 acres (to waterline) and is unpaved. The South Parcel is 5.5 acres in size. This parcel is mostly covered with grasses and weeds. The only surface area that is covered by gravel is the area that is being used to store abandoned ship repair equipment and excess parts (bone yard). Permanent structures on this parcel include a Quonset Hut for storing ship repair material and timber, a security shack, and a motor repair shed [see Supplemental Figure 3 from Parametrix (2002a)]. Historically this area was used for storage, manufacturing, and distributing of timber or lumber products. The mill was located on the east corner of the South Parcel (Parametrix 2002a).

South Parcel

Approximately two-thirds of the South Parcel's 5.5 acres is covered either by steel and concrete pads or with asphalt. The permanent structures that are currently being used to support ship repair operations (maintenance, fabrication, electrical/mechanical repairs, storage, etc.) include the following:

- Administrative buildings
- Boiler and plate shop
- Tool building
- Machine shop and garage
- Sandblasting and painting sheds/booths
- Electrical shop
- Fabrication/carpentry shop
- Oil/water separator plant
- Storage/warehouse facilities
- Compressor shed
- Loading dock
- Pulley/crane facilities.

There are also two marine ways used for pulling ships up to 1,000 tons out of the water to the upland shipyard facilities as well as an offshore floating dry dock that's designed to sink down to allow for ships as heavy as 4,000 tons to navigate into position for performing maintenance services. In the general vicinity of the upland shipways, the area is covered by concrete and/or asphalt. These shipways and shipyard support operations are located on Supplemental Figure 3 from Parametrix (2002a).

There are three aboveground storage tanks (ASTs). The material and capacity stored in these ASTs are as follows:

- Unleaded fuel – 250 gallons
- Diesel fuel – 1,500 gallons
- Oil and water materials - 20,000 gallons from the separator plant.

The tanks containing the fuel-type material are within a tank farm that is located in the uppermost western area of this parcel. There is no containment wall or berm encircling the tank farm. The oil/water separator plant is located south to the boilermaker/plate shop (Parametrix 2002a).

There have been three underground storage tanks (USTs) removed from the South Parcel. In April 1988, a 500-gallon gasoline UST was decommissioned near the existing Mar Com administrative offices. A report documenting the decommissioning of the USTs cannot be found at this time. Later, in July 1990 two USTs, a 2000-gallon gasoline tank and a 1000-gallon diesel tank, were removed from the area directly west of the current office (north of tank farm). Soil samples collected under these tanks did not contain detectable concentrations of TPH, BTEX, or gasoline-range TPH. Based on these results, the excavations were backfilled. The facility received a *No Further Action* letter, dated December 31, 1990, from DEQ.

6. CURRENT SITE USE

North Parcel

The majority of the North Parcel is vacant with the remaining areas used to store abandoned ship repair equipment and excess parts (bone yard). However, in specific areas near the bone yard, large surfaces have been permeated by oil or fuel because employees did not correctly implement hazardous waste disposal procedures when decommissioning standing equipment (Parametrix 2001). The presence of considerable amounts of sandblast grit just west of the Quonset Hut and north of the City's stormwater drain easement have also been noted [see Supplemental Figure 5 from Parametrix (2002a)].

South Parcel

Since mid-1995, the South Parcel has been used as a tug, barge, and ship-repair facility. General operations performed on this parcel include steel and piping repairs, welding, machinery overhauls, high-pressure water blasting, sand blasting, painting and electrical repairs. Chemical products stored and used onsite include diesel fuel, unleaded gasoline, lubricating oils, cleaning solvents, paints and thinner products, and sandblast grit. The majority of the protective coatings[2] are supplied by the ship owners. If any surplus materials remain after completing the overhaul of or maintenance to a ship's hull, then these residuals are returned to the owner.

In 1995, Advanced Disposal Technologies (ADT), Inc. conducted a property environmental evaluation during which they noted areas of soil covered with either slag (near loading dock), sandblast grit (next to shipways and sandblasting shed), or petroleum contaminated soil (north of loading dock, south of warehouse adjacent to easterly property boundary, and areas surrounding compressor shed/breakroom) (ADT 1995). These impacted soils are highlighted in Supplemental Figure 4 from Parametrix (2002b).

7. SITE USE HISTORY

Historical site features are shown on Supplemental Figure 4 from Parametrix (2002a).

North Parcel

Historic aerial photographs (reviewed by Integral) suggest that the northern section of the North Parcel has been used on an infrequent basis as a surface storage area for lumber and timber materials. Site use was concentrated in this area because the southern half of this parcel was located in the floodplain and this area was frequently submerged underwater. Sediments dredged from the river as part of maintenance operations were placed in this area during the 1970s (Parametrix 2002a).

South Parcel

Historic industrial activities conducted onsite include ship repair, machine shop and truck maintenance, steel foundry, storage of support equipment as well as storing and distributing manufactured lumber products. Historic uses were generally the same as current uses, including ship repair services and machining operations. Although operations haven't differed much from the facility's onset, various upland and shoreline buildings, structures, and utilities have been constructed

[2] Protective coatings consist of abrasive sandblasting followed with an application of marine formulated paints including epoxy, and/or polyurethane and latex finishes.

and then abandoned (Section 4). For example, the number of shipways, dry docks, or repair berths along the shoreline between 1905 and the early 1940s vacillated between two to five (Parametrix 2002a).

8. CURRENT AND HISTORIC SOURCES AND COPCS

The understanding of the historic and current potential upland and overwater sources at the facility is summarized in Table 1. Site features are shown in Supplemental Figure 5 from Parametrix (2002a). The following sections provide a brief discussion of the potential sources and COPCs at the site requiring additional discussion.

8.1. Uplands

North Parcel

Most of the petroleum hydrocarbon (diesel fuel, transmission fluid, or hydraulic oil) historical releases have been found in the vicinity of the abandoned mechanical equipment stockpile (bone yard). Releases primarily occurred adjacent to paved or unpaved roads where off-loading of standing equipment occurred (Parametrix 2001). TPH compounds and PAHs that are typical constituents of petroleum products impacted these surface soils. Soils in the southwest corner of the North Parcel also contain arsenic and lead.

South Parcel

Most of the petroleum-hydrocarbon-stained surface soils were observed near the fuel oil storage tanks, compressor shed, machine shop, pulley house, northeast sump, and administrative building. Fuel oil, gasoline, transmission fluids, and diesel fuel releases have occurred from maintenance activities on equipment, vessels, and associated support utilities. Piles of spent sandblast grit, and likely associated paint debris, are also located in the general vicinity of the upland shipways. The release of this material is associated with overhaul operations. Soil samples around these structures or facilities were collected and analyzed for TPH, PAH, and trace metals. Surface soil was first impacted by the releases, followed by the gradual impact of subsurface soil and groundwater (Parametrix 2002a).

8.2. Overwater Activities ☒ Yes ☐ No

A floating dry dock is located off of the facility's shoreline and is used to conduct ship repairs, hull overhauls, and maintenance services (e.g., mechanical/electrical retrofits). There are also floating structures, including barges located off of the shoreline and a floating dry dock that are considered to be support platforms relative to operations. Only minor overwater spills are reported in the DEQ spill database for this facility related to the industrial activities at the site (see below).

Mar Com leases four submerged areas from the Oregon Department of State Lands, as shown in Supplemental Figure, Exhibit A.

8.3. Spills

Known or documented spills at the Mar Com site were obtained either from DEQ's Emergency Response Information System (ERIS) database for the period of 1995 to 2004, from oil and chemical spills recorded from 1982 to 2003 by the U.S. Coast Guard and the National Response Center's centralized federal database [see Appendix E of the Portland Harbor Work Plan (Integral et al. 2004)], from facility-specific technical reports, or from DEQ correspondence. These spills are summarized below.

Date	Material(s) Released	Volume Spilled (gallons)	Spill Surface (gravel, asphalt, sewer)	Action Taken (yes/no)
~ 1970s	Barge in shipway tipped over releasing fuel oil	Unknown	In shipway	Yes[1]
Apr 1997	Hull paint	Approx 5	Willamette River	Unknown
Apr 1997	Oil-contaminated bilge water	20	Willamette River	Unknown
Oct 1997	Oily/Water materials	50	Willamette River	Unknown
6/6/2000	Lanolite	Unknown, 50 x 100 ft sheen	Willamette River	Yes

[1]The barge/fuel oil release was addressed at the time by excavating the saturated soils/material and placing it on the top of the bank adjacent to the spillway.

9. PHYSICAL SITE SETTING

Subsurface explorations at the Mar Com Shipyard have included test pits, soil probe borings, and monitoring wells since the mid-1990s. Explorations on the North Parcel include 23 test pits, 14 probe borings, and 5 monitoring wells. Explorations on the South Parcel included 24 probe borings and 8 monitoring wells. The following information on the conceptual geology and hydrogeology site model is summarized from previous environmental investigations, DEQ's Source Control Decision Memorandum (DEQ 2003), and the RI Draft Work Plan (Parametrix 2002b).

9.1. Geology

As summarized in the XPA (Parametrix 2002a), site characterization activities included the installation of 25 probe borings and 5 auger borings, which were completed as monitoring wells. These borings indicate that dredge fill ranges from 7 to 18 feet deep at the site. Underlying the dredge fill is fine-grained alluvium consisting of a sandy to clayey silt with traces of organic debris at approximately 19 feet bgs. Geologic cross sections are provided in Figure 2 and Supplemental Figures 5 through 8 from DEQ (2003).

9.2. Hydrogeology

A shallow aquifer has been identified in the fill material above the fine-grained alluvium. Thirteen monitoring wells have been installed at the site in the fill above the clayey silt alluvium. Water level elevations measured in five of the wells in November 2001 ranged from approximately 6 to 16 feet (above sea level). Insufficient water level elevation data are available to estimate site-specific groundwater flow direction(s). It is anticipated that groundwater flow is toward the river, with changes in river stage likely influencing local groundwater flow conditions at the site. The shallow groundwater beneath the site likely discharges to the Willamette River (DEQ 2003).

Insufficient data are available to estimate horizontal and vertical groundwater gradients and groundwater flow velocity or aquifer parameters.

Seep Locations. No groundwater seeps were identified at the site (GSI 2003).

10. NATURE AND EXTENT *(Current Understanding)*

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The current understanding of the nature and extent of contamination for the uplands portions of the site is summarized in this section and includes findings from eight environmental studies conducted since 1990.

10.1. Soil

10.1.1. Upland Soil Investigations ☒ Yes ☐ No

North Parcel

<u>Surface and Subsurface Soil.</u> Early environmental investigations concluded that surface soil contamination was limited to the areas within the southern half of this parcel (ADT 1995; Parametrix 2001, 2002a). For example, heavy oil-range TPH and PAH compounds were identified within fill materials along the parcel's southern property line [see Supplemental Figure 6 from Parametrix (2002a)]. Arsenic, chromium, copper, lead, zinc, and mercury as well as organotins were also detected at elevated concentrations in this area (Parametrix 2002a). This is the only area of the site associated with piles of sandblast grit and areas of stained soils.

Subsequent to DEQ's strategy recommendation in 1999 and notification of a property sale transaction for this section of the property, DEQ requested additional information about the site. Consequently, an RI for further subsurface and groundwater sampling was conducted to assess the extent of surface soil, subsurface soil, and groundwater contamination at the site (DEQ 2003). Soil sampling performed for the RI included 7, surface soil (ground surface to 0.5 feet bgs), 11 shallow soil (2 to 2.5 feet bgs), 14 push-probe borings (4 to 23.5 feet bgs), and sample collection from nine test pits [Supplemental Figure 4 from DEQ (2003)]. Metals detected in surface and subsurface soils were within normal background concentrations (DEQ 2003). Petroleum hydrocarbons (heavy oil) in surface and subsurface soils were detected at scattered locations but not at significant concentrations. PAHs were either not detected above MDLs or not detected at levels exceeding risk-based concentrations (RBCs) (DEQ 1998, 2001). PCBs were not detected above the MDL. The RI (DEQ 2003) reported the following minimum and maximum concentrations of analytes detected in soils at the site:

Analyte	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Total Petroleum Hydrocarbons (TPH)		
TPH-D	50 U	2,050
TPH-Dx (Heavy Oil Range)	50 U	1,910
Polycyclic Aromatic Hydrocarbons (PAHs)		
Acenaphthene	0.01 U	8.02
Benzo(a)anthracene	0.01 U	6.29
Benzo(a)pyrene	0.01 U	4.85
Benzo(b)fluoranthene	0.01 U	2.71
Dibenzo(a,h)anthracene	0.01 U	0.134
Pyrene	0.01 U	19.9
Metals		
Arsenic	0.325 U	12.5
Chromium	2.61	1,100
Copper	11.6	79.7
Lead	0.84	96.9
Mercury	0.1 U	0.289
Zinc	14.2	310
PCBs		
	0.02 U	0.04 U

mg/kg = milligrams per kilogram (ppm)
U = Analyte is below detection limits.

Sandblast Grit. Analysis of two sandblast grit piles revealed elevated concentrations of metals. The maximum concentrations included the following: arsenic (180 mg/kg), chromium (208 mg/kg), copper (3,790 mg/kg), lead (2,830 mg/kg), and zinc (6,610 mg/kg) (DEQ 2003).

South Parcel

Soil sampling for the XPA performed in the spring of 2000 was based on a request for additional information to further characterize areas with known contamination (Parametrix 2002a). Soil collection included 21 push-probe borings and sampling from 10 test pits [Supplemental Figure 5 from Parametrix (2002a)]. The investigation identified TPH and PAH compounds in subsurface soils. Metals were also detected at elevated concentrations in soils directly north and adjacent to shipways and in the fill material associated with the knoll. The results of the maximum concentrations of COCs for focused areas (Parametrix 2002a) are as follows:

Former Sawmill Site (northeast section). Probe borings collected between the area of Slag-1/2 and concrete loading ramp contained 1,2-dichlorobenzene at a concentration of 245 µg/kg. Chromium was also detected as high as 3,930 mg/kg.

Building C. Probe borings collected between the Grit-1/2 area contained the VOC analyte tetrachloroethene (PCE) at a concentration of 130 µg/kg. Chromium (472 mg/kg), copper (1,660 mg/kg), lead (154 mg/kg) and zinc (3,830 mg/kg) were detected at elevated concentrations in this area. Organotins were also detected at elevated concentrations for this area (1,490 µg/kg).

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Steel Fabrication. Probe borings collected near the building contained TPH and PCE concentrations of 4,160 mg/kg and 120 µg/kg, respectively.

Former Warehouse (east of Break Room)/Break Room/Compressor Shed. Probe borings collected directly east of the break room and southwest of the warehouse contained TPH concentrations of 116 mg/kg and 444 mg/kg, respectively. Chromium (26 mg/kg), copper (146 mg/kg), and mercury (49 mg/kg) was also detected at elevated concentrations within the general area. Organotins were also detected (185 µg/kg).

North of Dry Dock. Probe borings contained PCE concentrations within this general area as high as 9.15 µg/kg.

Knoll (southeast corner). Probe borings contained the PAH constituents benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h) anthracene and indeno(1,2,3-cd) pyrene at concentrations of 2.87, 2.97, 6.1, and 4.14, respectively. Samples also contained chromium, copper, lead and zinc at concentrations of 14; 1,570; 229; and 1,530 mg/kg, respectively. Organotins were also detected within this area but at low concentrations.

10.1.2. Riverbank Samples ☐ Yes ☒ No

10.1.3. Summary

Soil and sandblast grit located at the North Parcel's most southern area contains TPH, PAH, and metal contamination. South Parcel soils surrounding the fabrication building, concrete- loading ramp, breakroom/compressor shed, and upland slipways as well as the subsurface soils of the knoll contain TPH, VOCs, PAHs, and metals contamination (DEQ 2003; Parametrix 2002a).

DEQ (2003) excluded the North Parcel riverbank from their North Parcel Source Control Decision. They noted that additional investigation of this area will be included in the future South Parcel Source Control Decision.

10.2. Groundwater

10.2.1. Groundwater Investigations ☒ Yes ☐ No

Limited groundwater investigations have been conducted at the site. Investigations on the South Parcel include installation of three monitoring wells (MW-A, MW-B, and MW-C) in 1990 (RES 1990a) and MW-1 through MW-5 in 2001 (Parametrix 2001). The wells on the South Parcel were only sampled once immediately after installation. In addition to the single round of well samples, 17 groundwater samples were collected from probe boring located on the South Parcel in 2000.

The focus of investigations shifted in approximately early 2001to the North Parcel. Mar Com collected groundwater quality data from five monitoring wells and four probe borings between 2001 and 2003.

Locations of the groundwater investigation on the South Parcel are shown in Supplemental Figure 4 from Parametrix (2002b). Locations of the groundwater investigation on the North Parcel are shown in Supplemental Figure 4 from DEQ (2003).

10.2.2. NAPL (Historic & Current) ☐ Yes ☒ No

There is no documentation of NAPL at either the North Parcel or South Parcel.

This document currently under review by US EPA and its federal, state and tribal partners, and is subject to change in whole or part..

10.2.3. Dissolved Contaminant Plumes ☒ Yes ☐ No

North Parcel: Plume Characterization Status ☒ Complete ☐ Incomplete

DEQ's Source Control Decision Memorandum concludes that the extent of contamination in the North Parcel had been adequately investigated and that the groundwater beneath the North Parcel does not pose an unacceptable risk to the Willamette River (DEQ 2004).

South Parcel: Plume Characterization Status ☐ Complete ☒ Incomplete

Groundwater quality in the South Parcel was investigated during the 2000 Preliminary Soil and Groundwater Investigation (Parametrix 2001) and the 2001 Groundwater Investigation (Parametrix 2002a). In August 2002, Mar Com submitted a draft work plan for a remedial investigation to DEQ (Parametrix 2002b). The proposed work to complete the groundwater plume characterization included collection and analysis of groundwater samples in the machine shop area, the former warehouse and shop area, the compressor shed, offices and breakroom area, the former St. John ship-building facility, and the knoll area (Parametrix 2002b). This investigation has not been conducted to date.

Plume Extent

North Parcel

Screening level groundwater quality data were collected from four probe borings and five monitoring wells on the parcel between 2001 and 2003. The data indicated that total metals did not exceed upgradient concentrations; petroleum hydrocarbons were not detected above method detection limits; and PAHs, organotins, and VOCs either were not detected above method detection limits or were not detected above SLVs or RBCs (DEQ 2003).

South Parcel

Low levels of chlorinated VOCs and PAHs were detected in groundwater beneath the South Parcel. Two plumes appear to be present, trending north-northeast and south-southwest, with low-level chlorinated VOCs ranging up to 11.8 µg/L. A few low-level PAHs also were detected in one well, MW- 5 (Parametrix 2002a). Monitoring well MW-5 is located adjacent to the pile of TPH-contaminated soil placed at the top of the bank following the barge incident in the 1970s.

Min/Max Detections (Current situation)

North Parcel

Analyte	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)
Polycyclic Aromatic Hydrocarbons (PAHs)		
Acenaphthene	<0.01	1.86
Fluorene	<0.01	0.205
Phenanthrene	<0.02	1.2
Volatile Organic Compounds (VOCs)		
Chlorobenzene	<1.0	10.3
1,3-Dichlorobenzene	<1.0	1.9
1,4-Dichlorobenzene	<1.0	2.2

South Parcel

Analyte	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)
Polycyclic Aromatic Hydrocarbons (PAHs)		
Acenaphthene	<0.01	0.362
Fluorene	<0.01	0.209
Phenanthrene	<0.02	0.321
Naphthalene	<0.02	1.16
Volatile Organic Compounds (VOCs)		
Chloroform	<1.0	11.8
Tetrachloroethene	<1.0	9.15
1,1,1-Trichloroethane	<1.0	1.06

Current Plume Data

The current estimated extent of groundwater impacts is shown in Figure 3. This plume depicts detections of VOCs and PAHs.

Preferential Pathways

Three stormwater outfall structures are located on the property. However, no information has been presented regarding the depths of the utilities at the facility relative to the groundwater table or if they may be considered a preferential pathway at the site.

Downgradient Plume Monitoring Points (min/max detections)

North Parcel

Very low levels of PAHs and VOCs were detected in groundwater samples collected from the wells located furthest downgradient at the site (see maximum concentrations referenced in the Min/Max table above). Concentrations of constituents are below SLVs and RBCs (DEQ 1998, 2001), and DEQ has concluded the groundwater beneath the North Parcel does not pose an unacceptable risk to the river (DEQ 2003).

South Parcel

The limited dataset indicates that low concentrations of chlorinated VOCs and PAHs are present in the downgradient monitoring point (MW-5) for the southern plume (see Figure 3) at concentrations similar to those listed above. The northern plume's most downgradient concentrations are also similar to those listed above (see Figure 3).

Visual Seep Sample Data ☐ Yes ☒ No

Nearshore Porewater Data

No porewater data were documented in the references cited.

Groundwater Plume Temporal Trend

North Parcel

Although insufficient data are available to assess groundwater temporal trends based on either no detections or very low concentrations in the North Parcel groundwater, DEQ has concluded the groundwater beneath the North Parcel does not pose an unacceptable risk to the river (DEQ 2004).

South Parcel

Insufficient data are available to assess the temporal trend of the groundwater plumes.

10.2.4. Summary

Very limited groundwater data, both chemical and physical, are available for the Mar Com site. Given the location of the site, it is anticipated that groundwater flow is toward the Willamette River.

North Parcel

For the North Parcel, low levels of PAHs, organotins, and VOCs were detected in the groundwater. However, DEQ concluded that groundwater did not pose an unacceptable risk to the Willamette River based on AWQC and DEQ Level II screening levels (DEQ 2004).

South Parcel

The limited groundwater data for this parcel indicate that low levels of chlorinated VOCs and PAHs are in the shallow groundwater. Two plumes appear to be present, trending north-northeast and south-southwest, with low-level chlorinated VOCs ranging up to 11.8 µg/L. A few low-level PAHs also were detected in well MW- 5 (Parametrix 2002a). A remedial investigation work plan was submitted to DEQ, but has not been conducted. Characterization of the South Parcel groundwater plumes is not complete.

10.3. Surface Water

10.3.1. Surface Water Investigation ☒ Yes ☐ No

10.3.2. General or Individual Stormwater Permit (Current or Past) ☒ Yes ☐ No

Complete information relative to location of existing outfalls is not available at the time of this update. Approximate locations are shown in Figure 1.

Three private stormwater outfalls have been identified at the site:

- WR-86 (active)
- WR-219 (active)
- WR-286 (abandoned)

There is also a channelized stormwater drainage at the shipway skids that discharges to the river (appears to be designated by the City of Portland as WR-376; see Figure 1). This channelized drainage and Outfall WR-86 were monitored under the 1200Z NPDES permit. No information is available on what areas (onsite or offsite) drain to Outfall WR-219.

WR-286 was an abandoned PVC pipe located at the top of the bank on the north parcel (Sanders 2004, pers. comm.). This pipe was documented by City of Portland in their 1999 outfall survey (Sanders 2004, pers. comm.) but was not found by DEQ in 2004. No information was located regarding historic discharge from this pipe.

The facility also contains a City of Portland stormwater discharge easement that is centrally located on the facility's riverbank edge (offset from the delta-type indentation along the north parcel's shoreline). The City's Outfall 52A discharges to a drainage ditch that is approximately 200 feet or less from the river and drains primarily industrial lands and rights-of-way. The City reports that sheet flow drainage from the railroad property east of the north parcel, as well as sheet flow over compacted soil on the eastern portion of the north MarCom parcel, could enter the City's conveyance system [see Supplemental Figure Attachment A from Sanders (2004, pers. comm.); Outfall WR-286 indicated with former WP-286 identifier].

Permit Type	File Number	Start Date	Outfalls	Parameters/Frequency
GEN12Z	109794-15717 (expired)	2/16/98	WR-86, channelized drainage	Standard[1]/twice yearly

[1] Standard GEN12Z permit requirements include pH, oil and grease, total suspended solids, copper, lead, and zinc. *E. coli* may also be required.

Do other non-stormwater wastes discharge to the system? ☐ Yes ☒ No

10.3.3. Stormwater Data ☒ Yes ☐ No

In early 2000, a surface water sample for VOC analyses was collected from the outfall located on the northwest corner of the South Parcel that bisects the property (Parametrix 2002a). VOCs were undetected. The report also notes that potential COCs could be transported with stormwater to the river based on the site history and drainage system.

10.3.4. Catch Basin Solids Data ☐ Yes ☒ No

No catch basin solids data were listed in reports cited.

10.3.5. Wastewater Permit ☐ Yes ☒ No

No wastewater permit is reported as being on file with the DEQ for this facility, although an oil/water separator (capacity of 20,000 gallons) has been reported as being present on the facility's property (Parametrix 2002a).

DEQ (2003) excluded the floating dock from their North Parcel Source Control Decision even though the dock is located in the North Parcel. They noted that additional investigation of this area will be included in the future South Parcel Source Control Decision.

10.3.6. Wastewater Data ☐ Yes ☒ No

10.3.7. Summary

Since there are no catch basins, containment walls/screens, or berms, releases of material associated with the industrial activities conducted onsite have a high probability of being transported to the river through the stormwater system.

10.4. Sediment

10.4.1. River Sediment Data ☒ Yes ☐ No

Sediment sampling locations in the vicinity of Mar Com Shipyard facility are shown on Figure 1. EPA (Weston 1998) collected one sample adjacent to the site as part of the Portland Harbor Sediment Investigation. Parametrix (2002) collected sediment samples from three sites located just off shore of the facility's shoreline property for the XPA investigation. The City of Portland (2004) has also collected sediment samples in this vicinity. A total of three samples were collected in the general vicinity of the City's Outfall 52A, and then an additional two were collected offshore of Mar Com's shoreline property. There is also a single sample that was collected as part of the LWG's Round 1 investigation (Integral in prep.). A total of 10 surface (0 – 10 cm) samples and one core (0-90 cm) sample were collected adjacent to the facility. The surface sediment chemical data are summarized in Table 2.

The Source Control Decision (DEQ 2003) concluded that contaminant concentrations in beach sediment and nearshore, in-water sediment along the North Parcel are not likely from upland sources, because elevated contaminant concentrations were not detected in upland soils and shallow groundwater.

10.4.2. Summary

See Final CSM Update.

11. CLEANUP HISTORY AND SOURCE CONTROL MEASURES

11.1. Soil Cleanup/Source Control

In April 1988, EMS oversaw the removal of a 500-gallon gasoline UST when the facility's tenants were J.D.A.C. (EMS 1990). From interviews with individuals having institutional memory of historical practices, it appears that the UST was located near the Mar Com office. The EMS report indicates that a company was retained by the property owner to test, remove, and dispose of all abandoned drums and barrels on the property. A copy of the analytical results and decommissioning documentation are not available for review.

In July 1990, RES oversaw the removal of two USTs directly northeast of the tank farm. A soil sample was collected from under the UST and analyzed for TPH and hydrocarbons (RES 1990b). No contaminants were detected in the sample collected from beneath the diesel UST. The soil sample collected from beneath the gasoline tank contained non-gasoline-range TPH at a concentration of 353 mg/kg. Results from comparing the sample against DEQ Level II cleanup standards indicated that soil cleanup was not required. Thus, excavations were backfilled in August 1990. The facility received a *No Further Action* letter for the decommissioning from DEQ (December 1990).

DEQ (2003) published a Source Control Decision (with EPA supporting DEQ conclusions) for the North Parcel in December 2003 and a ROD in May 2004. They concluded that contaminant concentrations in beach sediment and nearshore, in-water sediment along the North Parcel are not likely from upland sources, because elevated contaminant concentrations were not detected in upland soils and shallow groundwater. The only areas that pose unacceptable risks to human health and the environment are several piles of sandblast grit and surficial soil contamination at the top of the riverbank. The selected remedy will likely be the removal of these grit piles and the offsite disposal of the contaminated soil (DEQ 2003).

11.2. Groundwater Cleanup/Source Control

No groundwater cleanups or source control measures are cited in the available documents.

11.3. Other

11.4. Potential for Recontamination from Upland Sources

See Final CSM Update.

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Figures:

Tables:

Supplemental Scanned Figures:

FIGURES

Map Document: (C:\GIS\Projects\Portland_Harbor\
LWG-Map-Projects\Conseptual_Site_Model\Sample_Locations.mxd)
Plot Date: 08/03/2004

Areal Photo Date: October 2001.
Base Map features from Portland Metro's RLIS.

The City of Portland Outfall mapping information is based on available records; no warranty, expressed or implied, is provided as to the completeness or accuracy of the information. Current layer updated June 2004.

Outfalls (private)
City Outfalls
City Outfalls (Abandoned)
Seep Photo Location (Not location of actual Seep)

River Miles
Navigation Channel
-35ft. Contour (NAVD 88)
Docks & In-water Structures
Selected ECSI Site Property Boundary

Human Use Areas
Dockside Worker
Recreational Beach Use
Transient

LWG Round 2 Proposed Sediment Samples
Surface Sample Only
Core & Surface Sample

0 100 200 400 Feet

DRAFT

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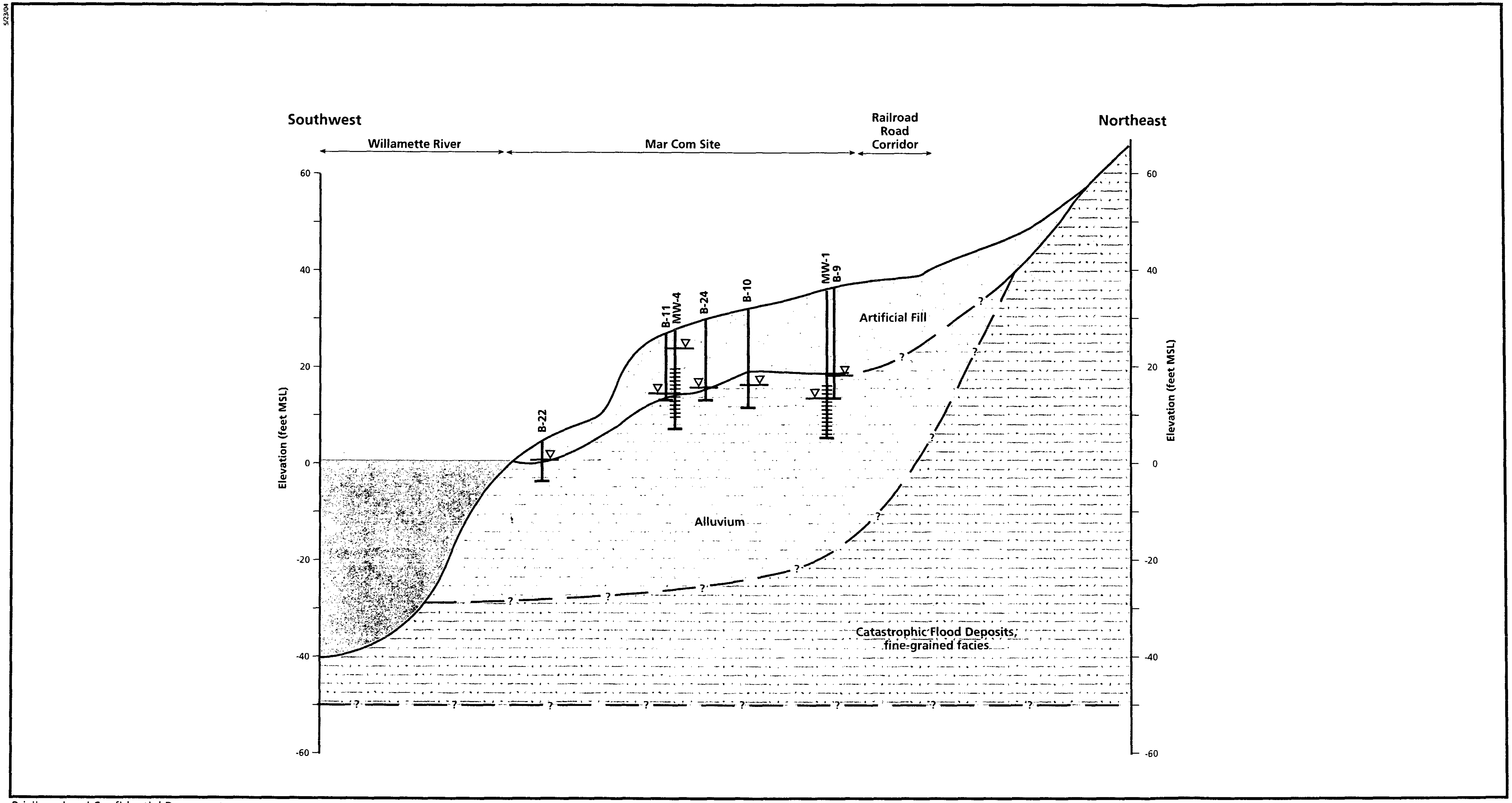
Figure 1
Portland Harbor
Conceptual Site Model
Mar Com, Inc.
ECSI 2350



Privileged and Confidential Document
Prepared in Anticipation of Litigation.

LWG
LOWER WILLAMETTE GROUP

Groundwater Solutions Inc.

LEGEND

0 20 40
HORIZONTAL SCALE IN FEET
VERTICAL SCALE: 1" = 115'

Scale and elevations are approximate.

References: Expanded Preliminary Assessment, MarCom Ship Repair Facility (Parametrix, 2002) Bathymetric Survey (DEA, 2002)

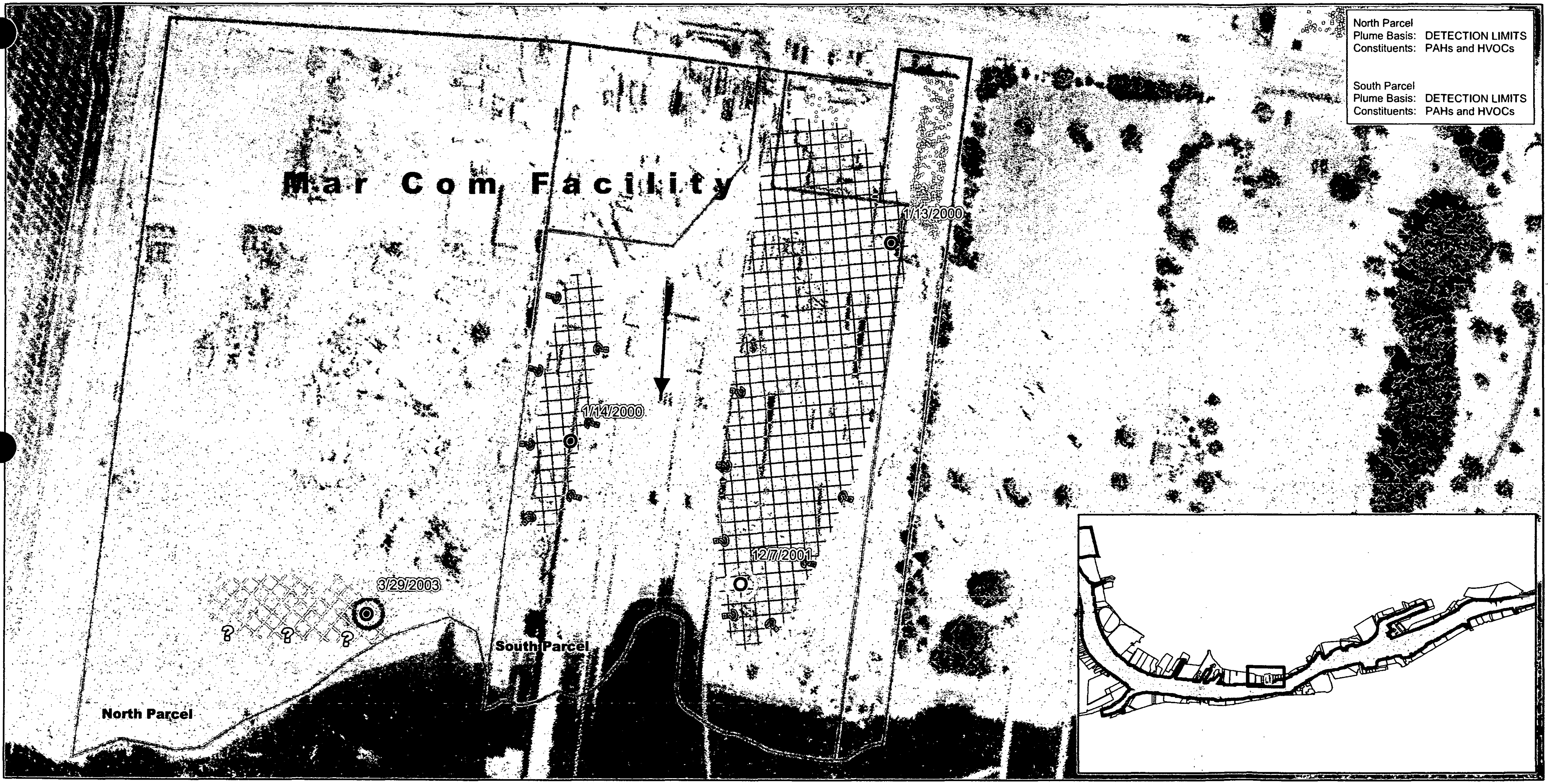
Note: Mostly interbedded silt and sand was noted on the boring logs.

LW-6D
- Boring/Well ID
- Surface elevation along profile
- Groundwater level
- Groundwater Flow
- Boring/Well, Projected
- Well screen
- Bottom of boring/well

- Artificial Fill — Fill
- Alluvium
- Catastrophic Flood Deposits, fine-grained facies — Pleistocene Flood Deposits and Recent Alluvium (undifferentiated sand and silt)

Figure 2
Portland Harbor RI/FS
Hydrogeologic Cross Section
Mar Com Facility
GROUNDWATER SOLUTIONS, INC.

DRAFT



Groundwater Solutions Inc.

LWG
LOWER WILLAMETTE GROUP

0 100 200 Feet

FEATURE SOURCES:
Transportation, Water, Property, Zoning or Boundaries: Metro RLIS.
ECSI site locations were summarized in December, 2002
and January, 2003 from ODEQ ECSI files.

Map Creation Date: August 11, 2004

File Name: Fig3_MarCom_SummaryMap.mxd

LEGEND

- Site Boundary
- General Groundwater Flow
- Maximum Detection Location

Contaminant Type

- PAHs
- VOCs (HVOCs)

Extent of Impacted Groundwater

For details, refer to plume interpretation table in CSM document.

- Single or isolated detection of COI's. Extent or continuity of impacted groundwater between sample points is uncertain. Color based on contaminant type.
- Estimated extent of impacted groundwater area. Color based on contaminant type.

Figure 3
Portland Harbor RI/FS
Mar Com Facility
Upland Groundwater Quality Overview

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TABLES

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Mar Com #2350

Table 1. Potential Sources and Transport Pathways Assessment

Last Updated: September 17, 2004

Potential Sources		Media Impacted					COIs																		Potential Complete Pathway				
							TPH			VOCs																			
Map Location	Description of Potential Source	Surface Soil	Subsurface Soil	Groundwater	Catch Basin Solids	River Sediment	Gasoline-Range	Diesel - Range	Heavier - Range	Petroleum-Related (e.g. BTEX)	VOCs	Chlorinated VOCs	SVOCs	PAHs	Phthalates	Phenolics	Metals	PCBs	Herbicides and Pesticides	Dioxins/Furans	Butyltins	[Others -List]	[Others -List]	[Others -List]	Overland Transport	Groundwater	Direct Discharge - Overwater	Direct Discharge - Storm/Wastewater	Riverbank Erosion
Upland Areas																													
North Parcel																													
Quonset Hut	Stained soil	✓						✓	✓					✓											?				
Southwest corner	Stained soil	✓						✓	✓		✓			✓			✓								✓			?	
Northeast of City's outfall and east of Quonset Hut	2 spent sandblast grit piles	✓													✓		✓				✓				?				
Riverbank	Soil	?	?																										
South Parcel																													
Former Sawmill (NE corner)	Soil	✓	✓	?				✓	✓		✓			✓			✓				✓					?		?	
Building C	Soil	✓	✓	✓					✓		✓	✓		✓			✓				✓					?		?	
Steel fabrication bldg	Soil	✓	✓	✓					✓		✓	✓		✓			✓				✓					?		?	
Former Warehouse/Break bldg.	Soil	✓	✓	?				✓						✓			✓	✓			✓					?		?	
Machine Shop			✓	✓					✓		✓	✓														?		?	
Compressor shed	Soil	✓	✓	✓													✓				✓					?		?	
Paint Booth		✓	✓	✓							✓	✓	✓		✓		✓									?		?	
Knoll (SE corner)	Soil	✓	✓	✓				✓	✓	✓				✓			✓				✓					?		?	
South's SW corner	Soil	✓	✓	?					✓		✓			✓			✓								✓	?		?	
Upland drydocks	Soil	✓	✓	?		✓							✓		✓		✓				✓				✓	?		?	✓
Overwater Areas																													
Floating Drydock	Overwater activities					✓		✓	✓		✓		✓	✓	✓		✓				✓						✓		✓
Other Areas/Other Issues																													

Notes:
[1] All information provided in this table is referenced in the site summaries. If information is not available or inconclusive, a ? may be used, as appropriate. No new information is provided in tl

✓ = Source, COI are present or currenor historic pathway is determined to be complete or potentially compl

? = There is not enough information to determine if source or COI is present or if pathway is complete

Blank = Source, COI and Historiand Current pathways have been investigated and shown to be not present or incompl

UST Underground storage Tank
AST Above-ground Storage Tank
TPH Total Petroleum Hydrocarbons
VOCs Volatile Organic Compounds
SVOCs Semi-volatile Organic Compounds
PAHs Polycyclic aromatic hydrocarbons
BTEX Benzene, toluene, ethylbenzene, and xylenes
PCBs Polychorinated biphenols

Table 2. Queried Sediment Chemistry Data

Surface or				N	%	Detected Concentrations					Detected and Nondetected Concentrations				
Subsurface	Analyte	Units	N	Detected	Detected	Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
surface	Aroclor 1016	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
surface	Aroclor 1242	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
surface	Aroclor 1248	(ug/kg)	1	0	0						73 U	73 U	73	73 U	73 U
surface	Aroclor 1254	(ug/kg)	1	1	100	250	250	250	250	250	250	250	250	250	250
surface	Aroclor 1260	(ug/kg)	1	0	0						170 U	170 U	170	170 U	170 U
surface	Aroclor 1221	(ug/kg)	1	0	0						39 U	39 U	39	39 U	39 U
surface	Aroclor 1232	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
surface	Polychlorinated biphenyl	(ug/kg)	1	1	100	250	250	250	250	250	250	250	250	250	250
surface	Butyltin ion	(ug/kg)	4	2	50	6 J	95.5	50.8	6 J	6 J	3.29 U	95.5	27.2	4.14 U	6 J
surface	Dibutyltin ion	(ug/kg)	4	2	50	17	253	135	17	17	2.47 U	253	68.9	3.1 U	17
surface	Dibutyltin ion	(ug/l)	1	0	0						0.06 U	0.06 U	0.06	0.06 U	0.06 U
surface	Tributyltin ion	(ug/kg)	4	4	100	43.7	819	297	117	210 J	43.7	819	297	117	210 J
surface	Tributyltin ion	(ug/l)	1	0	0						0.02 U	0.02 U	0.02	0.02 U	0.02 U
surface	Tetrabutyltin	(ug/kg)	4	1	25	7.14	7.14	7.14	7.14	7.14	1.64 U	7.14	4.19	2.07 U	5.9 U
surface	Tetrabutyltin	(ug/l)	1	0	0						0.02 U	0.02 U	0.02	0.02 U	0.02 U
surface	Total solids	(%)	1	1	100	60	60	60	60	60	60	60	60	60	60
surface	Total organic carbon	(%)	7	7	100	0.749	4.87	1.9	1.54	2.27	0.749	4.87	1.9	1.54	2.27
surface	Gravel	(%)	2	2	100	0.11	0.32	0.215	0.11	0.11	0.11	0.32	0.215	0.11	0.11
surface	Sand	(%)	1	1	100	58.48	58.48	58.5	58.48	58.48	58.48	58.48	58.5	58.48	58.48
surface	Very coarse sand	(%)	1	1	100	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
surface	Coarse sand	(%)	1	1	100	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
surface	Medium sand	(%)	1	1	100	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11
surface	Fine sand	(%)	1	1	100	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2
surface	Very fine sand	(%)	1	1	100	33	33	33	33	33	33	33	33	33	33
surface	Fines	(%)	1	1	100	41.41	41.41	41.4	41.41	41.41	41.41	41.41	41.4	41.41	41.41
surface	Silt	(%)	1	1	100	35.25	35.25	35.3	35.25	35.25	35.25	35.25	35.3	35.25	35.25
surface	Coarse silt	(%)	1	1	100	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1
surface	Medium silt	(%)	1	1	100	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
surface	Fine silt	(%)	1	1	100	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
surface	Very fine silt	(%)	1	1	100	1	1	1	1	1	1	1	1	1	1
surface	Clay	(%)	1	1	100	6.16	6.16	6.16	6.16	6.16	6.16	6.16	6.16	6.16	6.16
surface	8-9 Phi clay	(%)	1	1	100	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
surface	9-10 Phi clay	(%)	1	1	100	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
surface	>10 Phi clay	(%)	1	1	100	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
surface	Dalapon	(ug/kg)	2	0	0						1.72 U	87 U	44.4	1.72 U	1.72 U
surface	Dicamba	(ug/kg)	2	0	0						1.76 U	3.2 U	2.48	1.76 U	1.76 U
surface	MCPA	(ug/kg)	2	0	0						3.36 U	3200 U	1600	3.36 U	3.36 U
surface	Dichloroprop	(ug/kg)	2	0	0						2.84 U	6.5 UJ	4.67	2.84 U	2.84 U
surface	2,4-D	(ug/kg)	2	0	0						2.98 U	6.5 U	4.74	2.98 U	2.98 U
surface	Silvex	(ug/kg)	2	0	0						1.6 UJ	2.87 U	2.24	1.6 UJ	1.6 UJ
surface	2,4,5-T	(ug/kg)	2	0	0						2.9 UJ	3.51 U	3.21	2.9 UJ	2.9 UJ
surface	2,4-DB	(ug/kg)	2	0	0						2.15 U	32 U	17.1	2.15 U	2.15 U

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Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	N	N Detected	% Detected	Detected Concentrations Minimum	Detected Concentrations Maximum	Detected Concentrations Mean	Detected Concentrations Median	Detected Concentrations 95th	Detected and Nondetected Concentrations Minimum	Detected and Nondetected Concentrations Maximum	Detected and Nondetected Concentrations Mean	Detected and Nondetected Concentrations Median	Detected and Nondetected Concentrations 95th
surface	Dinoseb	(ug/kg)	2	0	0						2.46 U	3.2 UJ	2.83	2.46 U	2.46 U
surface	MCPP	(ug/kg)	2	0	0						1.5 U	3200 U	1600	1.5 U	1.5 U
surface	Aluminum	(mg/kg)	10	10	100	8470	32100	16600	13100	22400	8470	32100	16600	13100	22400
surface	Aluminum	(mg/l)	1	1	100	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
surface	Antimony	(mg/kg)	10	8	80	0.499	15.2	3.99	0.969	10.1	0.499	15.2	3.74	0.969	10.1
surface	Antimony	(mg/l)	1	0	0						0.05 U	0.05 U	0.05	0.05 U	0.05 U
surface	Arsenic	(mg/kg)	10	9	90	3.49	105	19.4	5.52	30.6	3.49	105	18	5.26	30.6
surface	Arsenic	(mg/l)	1	1	100	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
surface	Cadmium	(mg/kg)	10	2	20	0.24	0.4	0.32	0.24	0.24	0.24	0.5 U	0.36	0.334 U	0.41 U
surface	Cadmium	(mg/l)	1	0	0						0.002 U	0.002 U	0.002	0.002 U	0.002 U
surface	Chromium	(mg/kg)	10	10	100	27.6	220	63.2	40.1	109	27.6	220	63.2	40.1	109
surface	Chromium	(mg/l)	1	0	0						0.005 U	0.005 U	0.005	0.005 U	0.005 U
surface	Copper	(mg/kg)	10	10	100	39	1150	282	122	620	39	1150	282	122	620
surface	Copper	(mg/l)	1	0	0						0.002 U	0.002 U	0.002	0.002 U	0.002 U
surface	Lead	(mg/kg)	10	10	100	17.5 B	577	159	63.8 B	460	17.5 B	577	159	63.8 B	460
surface	Lead	(mg/l)	1	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Manganese	(mg/kg)	4	4	100	603	1440	1040	772	1330	603	1440	1040	772	1330
surface	Manganese	(mg/l)	1	1	100	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
surface	Mercury	(mg/kg)	10	8	80	0.027	0.125	0.088	0.09	0.12 J	0.027	0.125	0.09	0.1	0.12 J
surface	Mercury	(mg/l)	1	0	0						1E-04 U	1E-04 U	1E-04	1E-04 U	1E-04 U
surface	Nickel	(mg/kg)	10	10	100	20.1	167	47.3	27	91	20.1	167	47.3	27	91
surface	Nickel	(mg/l)	1	0	0						0.01 U	0.01 U	0.01	0.01 U	0.01 U
surface	Selenium	(mg/kg)	10	3	30	0.475	12	4.48	0.957	0.957	0.3 U	12	1.7	0.531 U	0.957
surface	Selenium	(mg/l)	1	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Silver	(mg/kg)	10	9	90	0.05	3.93	0.865	0.476	1.16	0.05	3.93	0.878	0.476	1.16
surface	Silver	(mg/l)	1	0	0						2E-04 U	2E-04 U	2E-04	2E-04 U	2E-04 U
surface	Thallium	(mg/kg)	4	2	50	0.45	21	10.7	0.45	0.45	0.397 U	21	5.59	0.45	0.5 U
surface	Thallium	(mg/l)	1	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Zinc	(mg/kg)	10	10	100	119	2010	402	215	388	119	2010	402	215	388
surface	Zinc	(mg/l)	1	1	100	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
surface	Barium	(mg/kg)	4	4	100	167	426	262	223	232	167	426	262	223	232
surface	Barium	(mg/l)	1	1	100	0.109	0.109	0.109	0.109	0.109	0.109	0.109	0.109	0.109	0.109
surface	Beryllium	(mg/kg)	4	4	100	0.459	0.869	0.633	0.54	0.665	0.459	0.869	0.633	0.54	0.665
surface	Beryllium	(mg/l)	1	0	0						0.001 U	0.001 U	0.001	0.001 U	0.001 U
surface	Calcium	(mg/kg)	4	4	100	8230 J	53800	31000	9410	52700	8230 J	53800	31000	9410	52700
surface	Calcium	(mg/l)	1	1	100	108	108	108	108	108	108	108	108	108	108
surface	Cobalt	(mg/kg)	4	4	100	16.9	55.5	33.8	26	36.7	16.9	55.5	33.8	26	36.7
surface	Cobalt	(mg/l)	1	1	100	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
surface	Iron	(mg/kg)	4	4	100	19100	84900	48000	37900	50100	19100	84900	48000	37900	50100
surface	Iron	(mg/l)	1	1	100	1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.83
surface	Magnesium	(mg/kg)	4	4	100	6120	14500	9770	6560	11900	6120	14500	9770	6560	11900
surface	Magnesium	(mg/l)	1	1	100	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9

Table 2. Queried Sediment Chemistry Data

Surface or				N	%			Detected Concentrations					Detected and Nondetected Concentrations		
Subsurface	Analyte	Units	N	Detected	Detected	Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
surface	Potassium	(mg/kg)	4	4	100	1140	50000	16700	5260	10200	1140	50000	16700	5260	10200
surface	Potassium	(mg/l)	1	1	100	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
surface	Sodium	(mg/kg)	4	4	100	1060	49000	16500	5270	10700	1060	49000	16500	5270	10700
surface	Sodium	(mg/l)	1	1	100	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
surface	Titanium	(mg/kg)	1	1	100	1760	1760	1760	1760	1760	1760	1760	1760	1760	1760
surface	Vanadium	(mg/kg)	4	4	100	85	147	109	91	112	85	147	109	91	112
surface	Vanadium	(mg/l)	1	0	0						0.003 U	0.003 U	0.003	0.003 U	0.003 U
surface	2-Methylnaphthalene	(ug/kg)	7	5	71.4	34.3 J	144	76.5	67	97	15.9 UJ	144	59.9	40.2	97
surface	Acenaphthene	(ug/kg)	10	7	70	31.9 J	268	133	85	250 J	15.9 UJ	268	100	40.3	250 J
surface	Acenaphthylene	(ug/kg)	10	6	60	20 J	139	56.7	35.2	71	15.9 UJ	139	43.1	26.8 U	71
surface	Anthracene	(ug/kg)	10	9	90	46	426	185	151	400	15.9 UJ	426	168	96	400
surface	Fluorene	(ug/kg)	10	8	80	25.6 J	250	109	65.8	215	15.9 UJ	250	91.6	33.5	215
surface	Naphthalene	(ug/kg)	10	6	60	24.4 J	318	144	69.7	210	15.9 UJ	318	96.1	26.8 U	210
surface	Phenanthrene	(ug/kg)	10	10	100	17.2 J	1820	685	438	1580 J	17.2 J	1820	685	438	1580 J
surface	Low Molecular Weight PAH	(ug/kg)	10	10	100	17.2 A	3186 A	1150	668.7 A	2470 J	17.2 A	3186 A	1150	668.7 A	2470 J
surface	Dibenz(a,h)anthracene	(ug/kg)	10	9	90	52.3	456	163	93.1	380 J	15.9 UJ	456	148	80	380 J
surface	Benz(a)anthracene	(ug/kg)	10	10	100	17.7 J	2600	690	315	1400 J	17.7 J	2600	690	315	1400 J
surface	Benzo(a)pyrene	(ug/kg)	10	10	100	38.3 J	2520	721	411	1400 J	38.3 J	2520	721	411	1400 J
surface	Benzo(b)fluoranthene	(ug/kg)	5	5	100	193	1500 J	599	484	500	193	1500 J	599	484	500
surface	Benzo(g,h,i)perylene	(ug/kg)	10	10	100	39.3 J	1940	504	279	950 J	39.3 J	1940	504	279	950 J
surface	Benzo(k)fluoranthene	(ug/kg)	5	5	100	215	1100 J	506	413	504	215	1100 J	506	413	504
surface	Chrysene	(ug/kg)	10	10	100	36.5 J	2540	748	390	1700 J	36.5 J	2540	748	390	1700 J
surface	Fluoranthene	(ug/kg)	10	10	100	31.9 J	3530	1200	762	2700	31.9 J	3530	1200	762	2700
surface	Indeno(1,2,3-cd)pyrene	(ug/kg)	10	10	100	33 J	2120	507	254	1000 J	33 J	2120	507	254	1000 J
surface	Pyrene	(ug/kg)	10	10	100	39.4 J	4060	1160	710	2100 J	39.4 J	4060	1160	710	2100 J
surface	Benzo(b+k)fluoranthene	(ug/kg)	6	6	100	105 J	4130	1330	564	2030 J	105 J	4130	1330	564	2030 J
surface	High Molecular Weight PAH	(ug/kg)	10	10	100	341.1 A	23896 A	6960	3814 A	14200 J	341.1 A	23896 A	6960	3814 A	14200 J
surface	Polycyclic Aromatic Hydrocarbons	(ug/kg)	9	9	100	358.3 A	27082 A	7160	4746 A	12030 A	358.3 A	27082 A	7160	4746 A	12030 A
surface	2,4'-Dichlorobiphenyl	(ug/kg)	5	3	60	0.65 JP	0.98 J	0.8	0.77 JP	0.77 JP	0.3 U	0.98 J	0.618	0.65 JP	0.77 JP
surface	2,2',5-Trichlorobiphenyl	(ug/kg)	5	0	0						0.3 U	0.48 U	0.39	0.39 U	0.4 U
surface	2,4,4'-Trichlorobiphenyl	(ug/kg)	5	5	100	0.32 JP	1.13	0.69	0.8 P	0.83 P	0.32 JP	1.13	0.69	0.8 P	0.83 P
surface	2,2',3,5'-Tetrachlorobiphenyl	(ug/kg)	5	5	100	0.75 P	1.31	0.948	0.91	0.96 P	0.75 P	1.31	0.948	0.91	0.96 P
surface	2,2',5,5'-Tetrachlorobiphenyl	(ug/kg)	5	5	100	0.48 JP	3.98 P	1.84	1.57 P	2.51 P	0.48 JP	3.98 P	1.84	1.57 P	2.51 P
surface	2,3',4,4'-Tetrachlorobiphenyl	(ug/kg)	5	5	100	1.37	2.79	1.86	1.54 P	2.11	1.37	2.79	1.86	1.54 P	2.11
surface	2,2',4,5,5'-Pentachlorobiphenyl	(ug/kg)	5	4	80	0.53	1.34	0.898	0.68 P	1.04	0.35 U	1.34	0.788	0.68 P	1.04
surface	2,3,3',4,4'-Pentachlorobiphenyl	(ug/kg)	5	1	20	0.22 JP	0.22 JP	0.22	0.22 JP	0.22 JP	0.13 U	0.22 JP	0.18	0.17 U	0.21 U
surface	2,3',4,4',5-Pentachlorobiphenyl	(ug/kg)	5	5	100	0.37 JP	0.81 JP	0.55	0.46 JP	0.71 JP	0.37 JP	0.81 JP	0.55	0.46 JP	0.71 JP
surface	2,2',3,3',4,4'-Hexachlorobiphenyl	(ug/kg)	5	4	80	0.29 JP	0.55 JP	0.413	0.4 JP	0.41 JP	0.14 U	0.55 JP	0.358	0.4 JP	0.41 JP
surface	2,2',3,4,4',5'-Hexachlorobiphenyl	(ug/kg)	5	5	100	0.58 J	1.56	1.29	1.44	1.52 P	0.58 J	1.56	1.29	1.44	1.52 P
surface	2,2',4,4',5,5'-Hexachlorobiphenyl	(ug/kg)	5	5	100	0.91	4.43	2.2	1.84	2.77	0.91	4.43	2.2	1.84	2.77
surface	2,2',3,3',4,4',5-Heptachlorobiphenyl	(ug/kg)	5	4	80	0.25 JP	0.49 JP	0.34	0.27 JP	0.35 JP	0.15 U	0.49 JP	0.302	0.27 JP	0.35 JP
surface	2,2',3,4,4',5,5'-Heptachlorobiphenyl	(ug/kg)	5	5	100	0.29 J	1.66 P	0.948	0.77 J	1.27	0.29 J	1.66 P	0.948	0.77 J	1.27

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	N	N Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	2,2',3,4',5,5',6-Heptachlorobiphenyl	(ug/kg)	5	4	80	0.25 JP	2.04	0.93	0.43	1 P	0.16 U	2.04	0.776	0.43	1 P
surface	2,4'-DDD	(ug/kg)	6	2	33.3	4.45 J	8.49 J	6.47	4.45 J	4.45 J	2.07 U	8.49 J	4.37	3.26 U	5.67 U
surface	2,4'-DDE	(ug/kg)	6	0	0						2.07 U	19 U	5.86	2.58 UJ	5.67 U
surface	2,4'-DDT	(ug/kg)	6	0	0						0.39 UJ	5.67 U	2.76	2.58 U	3.26 U
surface	4,4'-DDD	(ug/kg)	6	2	33.3	3.77 J	12.4 J	8.09	3.77 J	3.77 J	0.403 U	12.4 J	4.46	3.77 J	5.67 U
surface	4,4'-DDE	(ug/kg)	6	2	33.3	2.76 J	3.74 J	3.25	2.76 J	2.76 J	0.477 U	6.4 U	3.27	2.76 J	5.67 U
surface	4,4'-DDT	(ug/kg)	6	4	66.7	2.79 J	7.67	5.19	3.6 J	6.69	0.537 U	18 U	6.55	3.6 J	7.67
surface	Total of 3 isomers: pp-DDT,-DDD,-DDE	(ug/kg)	6	4	66.7	2.79 A	19.74 A	10.9	7.67 A	13.22 A	0.537 UA	19.74 A	10.3	7.67 A	18 UJ
surface	Aldrin	(ug/kg)	6	1	16.7	1.01 J	1.01 J	1.01	1.01 J	1.01 J	0.2 U	2.83 U	1.28	1.11 U	1.41 U
surface	alpha-Hexachlorocyclohexane	(ug/kg)	6	0	0						0.2 U	2.83 U	1.05	0.8 U	1.01 U
surface	beta-Hexachlorocyclohexane	(ug/kg)	6	0	0						0.878 U	3.6 U	1.81	1.09 UJ	2.83 U
surface	delta-Hexachlorocyclohexane	(ug/kg)	6	0	0						0.2 U	2.83 U	1.18	0.988 U	1.25 U
surface	gamma-Hexachlorocyclohexane	(ug/kg)	6	0	0						0.2 U	2.83 U	1.17	0.984 U	1.25 U
surface	cis-Chlordane	(ug/kg)	6	0	0						0.25 U	2.83 U	1.21	1.02 U	1.3 U
surface	trans-Chlordane	(ug/kg)	6	2	33.3	3.93 J	14.8	9.37	3.93 J	3.93 J	0.842 U	14.8	4.78	2.83 U	5.2 U
surface	Oxychlordane	(ug/kg)	6	0	0						0.39 U	5.67 U	2.76	2.58 U	3.26 U
surface	cis-Nonachlor	(ug/kg)	6	3	50	3.71 J	10.3	6.73	6.19 J	6.19 J	2.07 U	10.3	5.04	3.71 J	6.19 J
surface	trans-Nonachlor	(ug/kg)	6	0	0						0.39 U	5.67 U	2.76	2.58 U	3.26 U
surface	Dieldrin	(ug/kg)	6	1	16.7	3.67 J	3.67 J	3.67	3.67 J	3.67 J	0.68 U	9.1 U	3.51	1.07 U	5.67 U
surface	alpha-Endosulfan	(ug/kg)	6	1	16.7	4.11	4.11	4.11	4.11	4.11	0.883 U	4.11	2.29	1.1 UJ	3.7 U
surface	beta-Endosulfan	(ug/kg)	6	0	0						0.39 U	5.67 U	1.69	0.995 U	1.26 U
surface	Endosulfan sulfate	(ug/kg)	6	2	33.3	4.44 J	5.85	5.15	4.44 J	4.44 J	0.39 U	5.85	2.26	0.937 U	4.44 J
surface	Endrin	(ug/kg)	6	0	0						0.57 U	5.67 U	1.67	0.929 U	1.18 U
surface	Endrin aldehyde	(ug/kg)	6	0	0						0.846 U	5.67 U	2.14	1.05 UJ	2.9 U
surface	Endrin ketone	(ug/kg)	6	0	0						0.39 U	5.67 U	1.5	0.724 U	0.916 U
surface	Heptachlor	(ug/kg)	6	0	0						0.2 U	2.83 U	1.11	0.887 U	1.12 U
surface	Heptachlor epoxide	(ug/kg)	6	0	0						0.2 U	2.83 U	1.14	0.941 U	1.19 U
surface	Methoxychlor	(ug/kg)	6	0	0						2 U	28.3 U	7.46	3.55 U	4.49 U
surface	Mirex	(ug/kg)	1	0	0						0.39 U	0.39 U	0.39	0.39 U	0.39 U
surface	Toxaphene	(ug/kg)	6	0	0						13 U	283 U	91.4	16.1 UJ	200 U
surface	Chlordane (cis & trans)	(ug/kg)	5	0	0						2.92 U	28.3 U	8.61	3.63 UJ	4.59 U
surface	Diesel fuels	(mg/kg)	5	5	100	25.3	185	88.5	75.7	82.7	25.3	185	88.5	75.7	82.7
surface	Lube Oil	(mg/kg)	5	5	100	129	406	302	322	377	129	406	302	322	377
surface	2,3,4,6-Tetrachlorophenol	(ug/kg)	6	0	0						19.7 U	209 U	116	96 U	192 U
surface	2,4,5-Trichlorophenol	(ug/kg)	7	0	0						19.7 U	209 U	114	99 U	192 U
surface	2,4,6-Trichlorophenol	(ug/kg)	7	0	0						19.7 U	209 U	114	99 U	192 U
surface	2,4-Dichlorophenol	(ug/kg)	7	0	0						19.7 U	209 U	103	60 U	192 U
surface	2,4-Dimethylphenol	(ug/kg)	7	0	0						19.7 U	209 U	96.9	58 U	192 U
surface	2,4-Dinitrophenol	(ug/kg)	6	0	0						98.4 U	1040 U	531	190 U	958 U
surface	2-Chlorophenol	(ug/kg)	7	0	0						19 UJ	209 U	91.4	20.9 UJ	192 U
surface	2-Methylphenol	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U
surface	2-Nitrophenol	(ug/kg)	7	0	0						19.7 U	209 U	114	99 U	192 U

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Table 2. Queried Sediment Chemistry Data

Surface or				N	%		Detected Concentrations					Detected and Nondetected Concentrations			
Subsurface	Analyte	Units	N	Detected	Detected	Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
surface	4,6-Dinitro-2-methylphenol	(ug/kg)	7	0	0						98.4 U	1040 U	484	200 UJ	958 U
surface	4-Chloro-3-methylphenol	(ug/kg)	7	0	0						19.7 U	209 U	97.1	40 U	192 U
surface	4-Methylphenol	(ug/kg)	7	3	42.9	41.6 J	350	156	75	75	41.6 J	417 U	233	319 UJ	383 U
surface	4-Nitrophenol	(ug/kg)	8	0	0						1.71 U	1040 U	399	99 U	958 U
surface	Pentachlorophenol	(ug/kg)	8	1	12.5	11.5	11.5	11.5	11.5	11.5	11.5	209 U	94.9	48 UJ	192 U
surface	Phenol	(ug/kg)	7	0	0						19.7 UJ	209 U	94.2	39 UJ	192 U
surface	2,3,4,5-Tetrachlorophenol	(ug/kg)	1	0	0						96 U	96 U	96	96 U	96 U
surface	2,3,5,6-Tetrachlorophenol	(ug/kg)	6	0	0						19.7 U	209 U	116	96 U	192 U
surface	Dimethyl phthalate	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U
surface	Diethyl phthalate	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U
surface	Dibutyl phthalate	(ug/kg)	7	0	0						19.7 U	209 U	95.8	50 U	192 U
surface	Butylbenzyl phthalate	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U
surface	Di-n-octyl phthalate	(ug/kg)	7	2	28.6	64.5 J	212	138	64.5 J	64.5 J	19 U	212	125	159 UJ	209 U
surface	Bis(2-ethylhexyl) phthalate	(ug/kg)	7	6	85.7	180 J	1510 J	500	277 J	485	120 U	1510 J	445	277 J	485
surface	Azobenzene	(ug/kg)	1	0	0						19 U	19 U	19	19 U	19 U
surface	Bis(2-chloro-1-methylethyl) ether	(ug/kg)	2	0	0						19 U	20 UJ	19.5	19 U	19 U
surface	2,4-Dinitrotoluene	(ug/kg)	7	0	0						19.7 U	209 U	114	99 U	192 U
surface	2,6-Dinitrotoluene	(ug/kg)	7	0	0						19.7 U	209 U	114	99 U	192 U
surface	2-Chloronaphthalene	(ug/kg)	7	0	0						1.97 U	20.9 U	14.2	19 U	20 U
surface	2-Nitroaniline	(ug/kg)	7	0	0						19.7 U	209 U	114	99 U	192 U
surface	3,3'-Dichlorobenzidine	(ug/kg)	7	0	0						19.7 U	209 U	114	99 U	192 U
surface	3-Nitroaniline	(ug/kg)	7	0	0						19.7 U	209 U	120	120 UJ	192 U
surface	4-Bromophenyl phenyl ether	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U
surface	4-Chloroaniline	(ug/kg)	7	0	0						19.7 U	209 U	103	60 UJ	192 U
surface	4-Chlorophenyl phenyl ether	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U
surface	4-Nitroaniline	(ug/kg)	7	1	14.3	39 J	39 J	39	39 J	39 J	20.9 UJ	209 U	116	99 UJ	192 U
surface	Aniline	(ug/kg)	6	0	0						19 U	209 U	103	20.9 UJ	192 U
surface	Benzoic acid	(ug/kg)	7	0	0						98.4 U	1040 U	484	200 U	958 U
surface	Benzyl alcohol	(ug/kg)	7	3	42.9	21.6 J	244 J	117	85.4 J	85.4 J	20 UJ	244 J	119	96 U	209 U
surface	Bis(2-chloroethoxy) methane	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U
surface	Bis(2-chloroethyl) ether	(ug/kg)	7	0	0						19.7 U	209 U	97.1	40 UJ	192 U
surface	Carbazole	(ug/kg)	7	5	71.4	64.9	219 J	145	140 J	171 J	64.9	219 J	156	159 UJ	209 U
surface	Dibenzofuran	(ug/kg)	7	4	57.1	46	150 J	86.8	57	94.1 J	46	209 U	130	150 J	192 U
surface	Hexachlorobenzene	(ug/kg)	12	2	16.7	1.31 J	1.77 J	1.54	1.31 J	1.31 J	0.2 U	209 U	52.4	2.83 U	192 U
surface	Hexachlorobutadiene	(ug/kg)	12	0	0						0.36 U	209 U	52.4	2.83 U	192 U
surface	Hexachlorocyclopentadiene	(ug/kg)	7	0	0						19.7 U	209 U	114	99 UJ	192 U
surface	Hexachloroethane	(ug/kg)	12	0	0						1.04 U	209 U	53.2	9.7 U	192 U
surface	Isophorone	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U
surface	Nitrobenzene	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U
surface	N-Nitrosodimethylamine	(ug/kg)	6	0	0						96 U	1040 U	516	105 UJ	958 U
surface	N-Nitrosodipropylamine	(ug/kg)	7	0	0						19.7 U	209 U	97.1	40 U	192 U
surface	N-Nitrosodiphenylamine	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U

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Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	N	N Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Bis(2-chloroisopropyl) ether	(ug/kg)	5	0	0						19.7 U	209 U	120	159 UJ	192 U
surface	1,2-Dichlorobenzene	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U
surface	1,3-Dichlorobenzene	(ug/kg)	7	0	0						19 U	209 U	91.4	20.9 UJ	192 U
surface	1,4-Dichlorobenzene	(ug/kg)	7	0	0						19 UJ	209 U	91.4	20.9 UJ	192 U
surface	1,2,4-Trichlorobenzene	(ug/kg)	7	0	0						19 UJ	209 U	91.4	20.9 UJ	192 U
subsurface	Butyltin ion	(ug/kg)	1	1	100	37	37	37	37	37	37	37	37	37	37
subsurface	Dibutyltin ion	(ug/kg)	1	1	100	100 J	100 J	100	100 J	100 J	100 J	100 J	100	100 J	100 J
subsurface	Tributyltin ion	(ug/kg)	1	1	100	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
subsurface	Tetrabutyltin	(ug/kg)	1	1	100	8	8	8	8	8	8	8	8	8	8
subsurface	Total organic carbon	(%)	1	1	100	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
subsurface	Gravel	(%)	1	1	100	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
subsurface	Sand	(%)	1	1	100	46.98	46.98	47	46.98	46.98	46.98	46.98	47	46.98	46.98
subsurface	Fines	(%)	1	1	100	51.89	51.89	51.9	51.89	51.89	51.89	51.89	51.9	51.89	51.89
subsurface	Silt	(%)	1	1	100	42.34	42.34	42.3	42.34	42.34	42.34	42.34	42.3	42.34	42.34
subsurface	Clay	(%)	1	1	100	9.55	9.55	9.55	9.55	9.55	9.55	9.55	9.55	9.55	9.55
subsurface	Aluminum	(mg/kg)	1	1	100	34400	34400	34400	34400	34400	34400	34400	34400	34400	34400
subsurface	Arsenic	(mg/kg)	1	0	0						8 U	8 U	8	8 U	8 U
subsurface	Cadmium	(mg/kg)	1	1	100	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
subsurface	Chromium	(mg/kg)	1	1	100	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5
subsurface	Copper	(mg/kg)	1	1	100	151	151	151	151	151	151	151	151	151	151
subsurface	Lead	(mg/kg)	1	1	100	131	131	131	131	131	131	131	131	131	131
subsurface	Manganese	(mg/kg)	1	1	100	662	662	662	662	662	662	662	662	662	662
subsurface	Mercury	(mg/kg)	1	1	100	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
subsurface	Nickel	(mg/kg)	1	1	100	37 J	37 J	37	37 J	37 J	37 J	37 J	37	37 J	37 J
subsurface	Selenium	(mg/kg)	1	1	100	11	11	11	11	11	11	11	11	11	11
subsurface	Silver	(mg/kg)	1	1	100	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
subsurface	Thallium	(mg/kg)	1	0	0						8 U	8 U	8	8 U	8 U
subsurface	Zinc	(mg/kg)	1	1	100	213	213	213	213	213	213	213	213	213	213
subsurface	Barium	(mg/kg)	1	1	100	191	191	191	191	191	191	191	191	191	191
subsurface	Beryllium	(mg/kg)	1	1	100	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
subsurface	Calcium	(mg/kg)	1	1	100	12500	12500	12500	12500	12500	12500	12500	12500	12500	12500
subsurface	Cobalt	(mg/kg)	1	1	100	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8
subsurface	Iron	(mg/kg)	1	1	100	45300	45300	45300	45300	45300	45300	45300	45300	45300	45300
subsurface	Magnesium	(mg/kg)	1	1	100	7560	7560	7560	7560	7560	7560	7560	7560	7560	7560
subsurface	Potassium	(mg/kg)	1	1	100	1270	1270	1270	1270	1270	1270	1270	1270	1270	1270
subsurface	Sodium	(mg/kg)	1	1	100	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030
subsurface	Titanium	(mg/kg)	1	1	100	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
subsurface	Vanadium	(mg/kg)	1	1	100	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6
subsurface	2-Methylnaphthalene	(ug/kg)	1	1	100	280 J	280 J	280	280 J	280 J	280 J	280 J	280	280 J	280 J
subsurface	Acenaphthene	(ug/kg)	1	1	100	440 J	440 J	440	440 J	440 J	440 J	440 J	440	440 J	440 J
subsurface	Acenaphthylene	(ug/kg)	1	1	100	74 J	74 J	74	74 J	74 J	74 J	74 J	74	74 J	74 J
subsurface	Anthracene	(ug/kg)	1	1	100	390	390	390	390	390	390	390	390	390	390

Table 2. Queried Sediment Chemistry Data

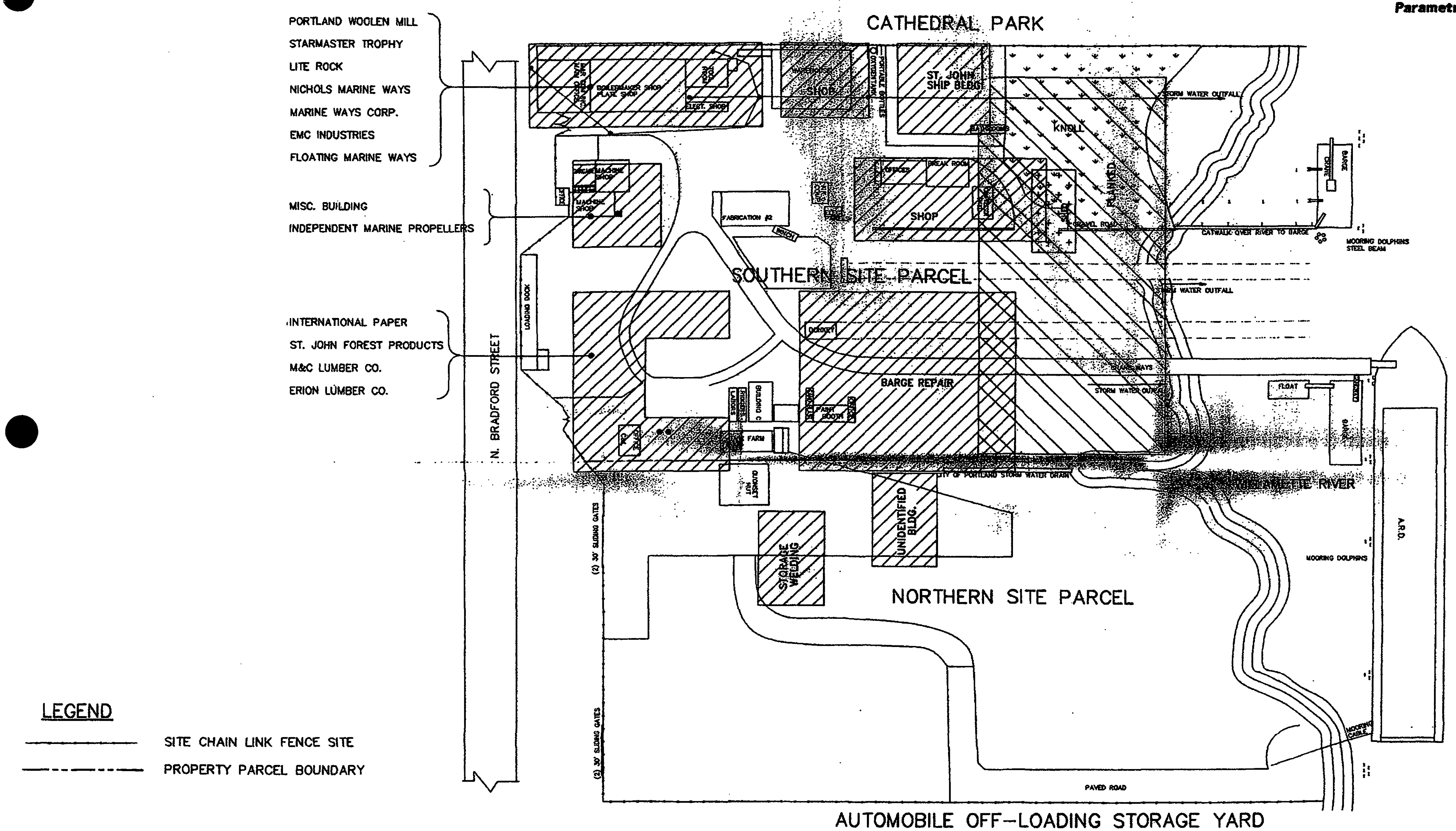
Surface or				N	%	Detected Concentrations					Detected and Nondetected Concentrations				
Subsurface	Analyte	Units	N	Detected	Detected	Minimum	Maximum	Mean	Median	95th	Minimum	Maximum	Mean	Median	95th
subsurface	Fluorene	(ug/kg)	1	1	100	460 J	460 J	460	460 J	460 J	460 J	460 J	460	460 J	460 J
subsurface	Naphthalene	(ug/kg)	1	1	100	560 J	560 J	560	560 J	560 J	560 J	560 J	560	560 J	560 J
subsurface	Phenanthrene	(ug/kg)	1	1	100	2400 J	2400 J	2400	2400 J	2400 J	2400 J	2400 J	2400	2400 J	2400 J
subsurface	Low Molecular Weight PAH	(ug/kg)	1	1	100	4324 A	4324 A	4320	4324 A	4324 A	4324 A	4324 A	4320	4324 A	4324 A
subsurface	Dibenz(a,h)anthracene	(ug/kg)	1	1	100	100 N	100 N	100	100 N	100 N	100 N	100 N	100	100 N	100 N
subsurface	Benz(a)anthracene	(ug/kg)	1	1	100	870	870	870	870	870	870	870	870	870	870
subsurface	Benzo(a)pyrene	(ug/kg)	1	1	100	910	910	910	910	910	910	910	910	910	910
subsurface	Benzo(b)fluoranthene	(ug/kg)	1	1	100	960	960	960	960	960	960	960	960	960	960
subsurface	Benzo(g,h,i)perylene	(ug/kg)	1	1	100	380	380	380	380	380	380	380	380	380	380
subsurface	Benzo(k)fluoranthene	(ug/kg)	1	1	100	680	680	680	680	680	680	680	680	680	680
subsurface	Chrysene	(ug/kg)	1	1	100	840	840	840	840	840	840	840	840	840	840
subsurface	Fluoranthene	(ug/kg)	1	1	100	3000 J	3000 J	3000	3000 J	3000 J	3000 J	3000 J	3000	3000 J	3000 J
subsurface	Indeno(1,2,3-cd)pyrene	(ug/kg)	1	1	100	510	510	510	510	510	510	510	510	510	510
subsurface	Pyrene	(ug/kg)	1	1	100	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
subsurface	Benzo(b+k)fluoranthene	(ug/kg)	1	1	100	1640 A	1640 A	1640	1640 A	1640 A	1640 A	1640 A	1640	1640 A	1640 A
subsurface	High Molecular Weight PAH	(ug/kg)	1	1	100	9650 A	9650 A	9650	9650 A	9650 A	9650 A	9650 A	9650	9650 A	9650 A
subsurface	Polycyclic Aromatic Hydrocarbons	(ug/kg)	1	1	100	13974 A	13974 A	14000	13974 A	13974 A	13974 A	13974 A	14000	13974 A	13974 A
subsurface	2,4,5-Trichlorophenol	(ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
subsurface	2,4,6-Trichlorophenol	(ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
subsurface	2,4-Dichlorophenol	(ug/kg)	1	0	0						59 U	59 U	59	59 U	59 U
subsurface	2,4-Dimethylphenol	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	2,4-Dinitrophenol	(ug/kg)	1	0	0						200 UJ	200 UJ	200	200 UJ	200 UJ
subsurface	2-Chlorophenol	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	2-Methylphenol	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	2-Nitrophenol	(ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
subsurface	4,6-Dinitro-2-methylphenol	(ug/kg)	1	0	0						200 U	200 U	200	200 U	200 U
subsurface	4-Chloro-3-methylphenol	(ug/kg)	1	0	0						39 U	39 U	39	39 U	39 U
subsurface	4-Methylphenol	(ug/kg)	1	1	100	120 J	120 J	120	120 J	120 J	120 J	120 J	120	120 J	120 J
subsurface	4-Nitrophenol	(ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
subsurface	Pentachlorophenol	(ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
subsurface	Phenol	(ug/kg)	1	1	100	26 J	26 J	26	26 J	26 J	26 J	26 J	26	26 J	26 J
subsurface	Dimethyl phthalate	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	Diethyl phthalate	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	Dibutyl phthalate	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	Butylbenzyl phthalate	(ug/kg)	1	1	100	28 N	28 N	28	28 N	28 N	28 N	28 N	28	28 N	28 N
subsurface	Di-n-octyl phthalate	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	Bis(2-ethylhexyl) phthalate	(ug/kg)	1	1	100	310	310	310	310	310	310	310	310	310	310
subsurface	Bis(2-chloro-1-methylethyl) ether	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	2,4-Dinitrotoluene	(ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
subsurface	2,6-Dinitrotoluene	(ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
subsurface	2-Chloronaphthalene	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	2-Nitroaniline	(ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Units	N	N Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
subsurface	3,3'-Dichlorobenzidine	(ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
subsurface	3-Nitroaniline	(ug/kg)	1	0	0						120 U	120 U	120	120 U	120 U
subsurface	4-Bromophenyl phenyl ether	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	4-Chloroaniline	(ug/kg)	1	0	0						59 U	59 U	59	59 U	59 U
subsurface	4-Chlorophenyl phenyl ether	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	4-Nitroaniline	(ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
subsurface	Benzoic acid	(ug/kg)	1	1	100	580 J	580 J	580	580 J	580 J	580 J	580 J	580	580 J	580 J
subsurface	Benzyl alcohol	(ug/kg)	1	1	100	9.4 JN	9.4 JN	9.4	9.4 JN	9.4 JN	9.4 JN	9.4 JN	9.4	9.4 JN	9.4 JN
subsurface	Bis(2-chloroethoxy) methane	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	Bis(2-chloroethyl) ether	(ug/kg)	1	0	0						39 U	39 U	39	39 U	39 U
subsurface	Carbazole	(ug/kg)	1	1	100	77	77	77	77	77	77	77	77	77	77
subsurface	Dibenzofuran	(ug/kg)	1	1	100	340 J	340 J	340	340 J	340 J	340 J	340 J	340	340 J	340 J
subsurface	Hexachlorobenzene	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	Hexachlorobutadiene	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	Hexachlorocyclopentadiene	(ug/kg)	1	0	0						98 U	98 U	98	98 U	98 U
subsurface	Hexachloroethane	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	Isophorone	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	Nitrobenzene	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	N-Nitrosodipropylamine	(ug/kg)	1	0	0						39 U	39 U	39	39 U	39 U
subsurface	N-Nitrosodiphenylamine	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	1,2-Dichlorobenzene	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	1,3-Dichlorobenzene	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	1,4-Dichlorobenzene	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U
subsurface	1,2,4-Trichlorobenzene	(ug/kg)	1	0	0						20 U	20 U	20	20 U	20 U

SUPPLEMENTAL FIGURES

Parametrix, Inc.



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NOT TO SCALE

Figure 4
Historical Site Features

MAR COM FACILITY
PORTLAND, OREGON

Parametrix, Inc.

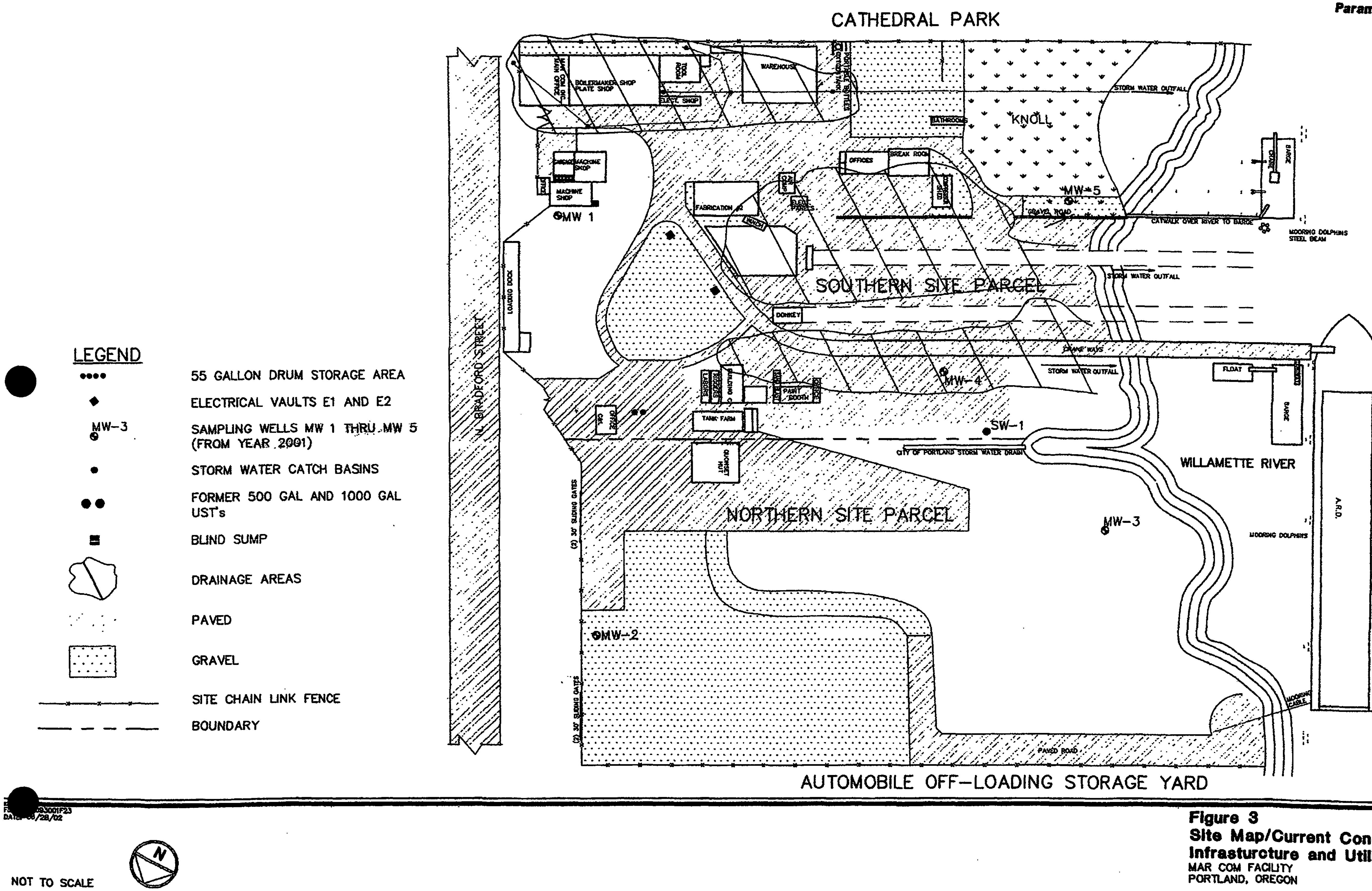

Figure 3
Site Map/Current Conditions Infrasturcture and Utilities
MAR COM FACILITY
PORTLAND, OREGON

Parametrix, Inc.

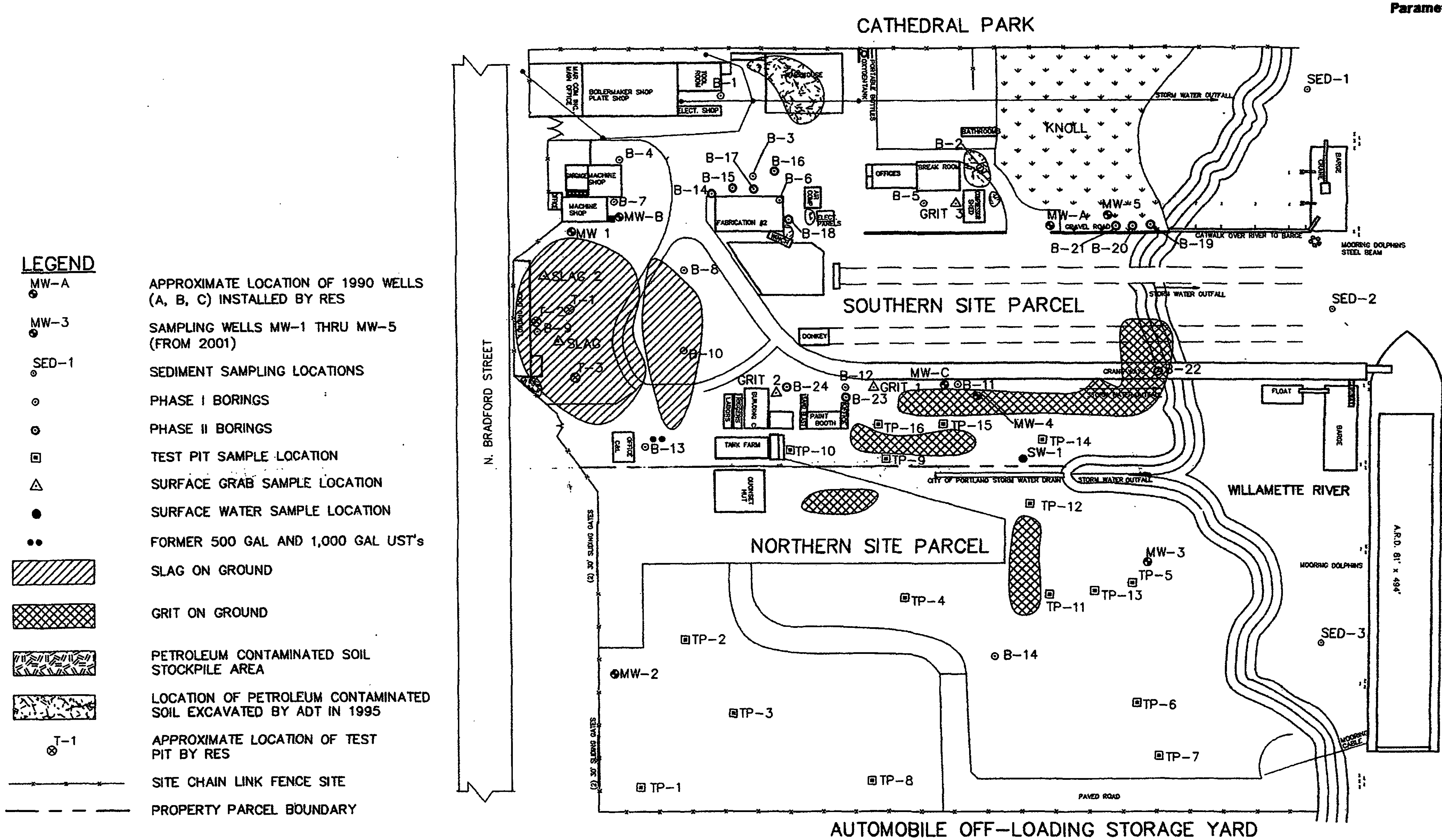

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Figure 5
Site Investigation Areas

MAR COM FACILITY
PORTLAND, OREGON

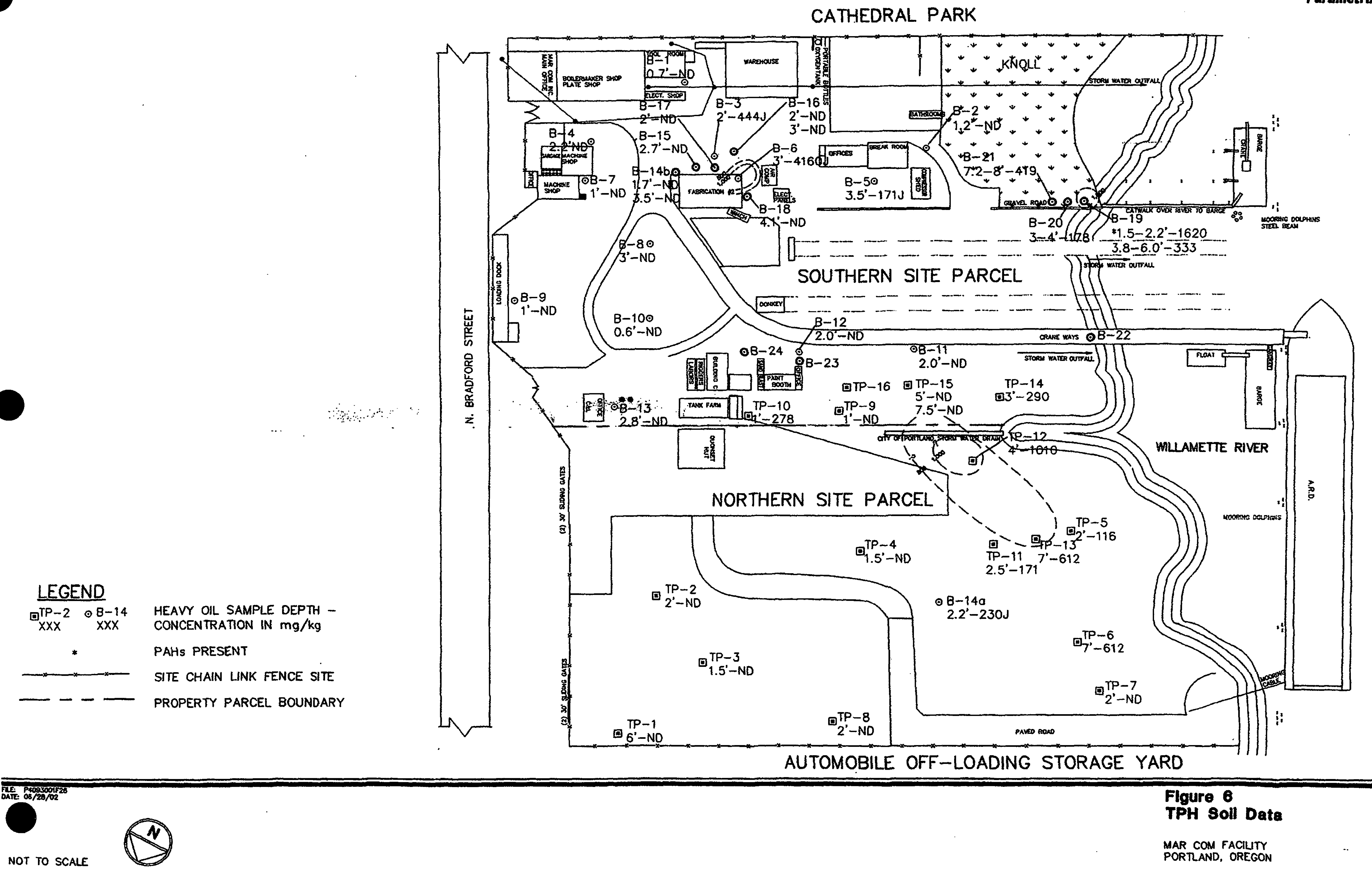

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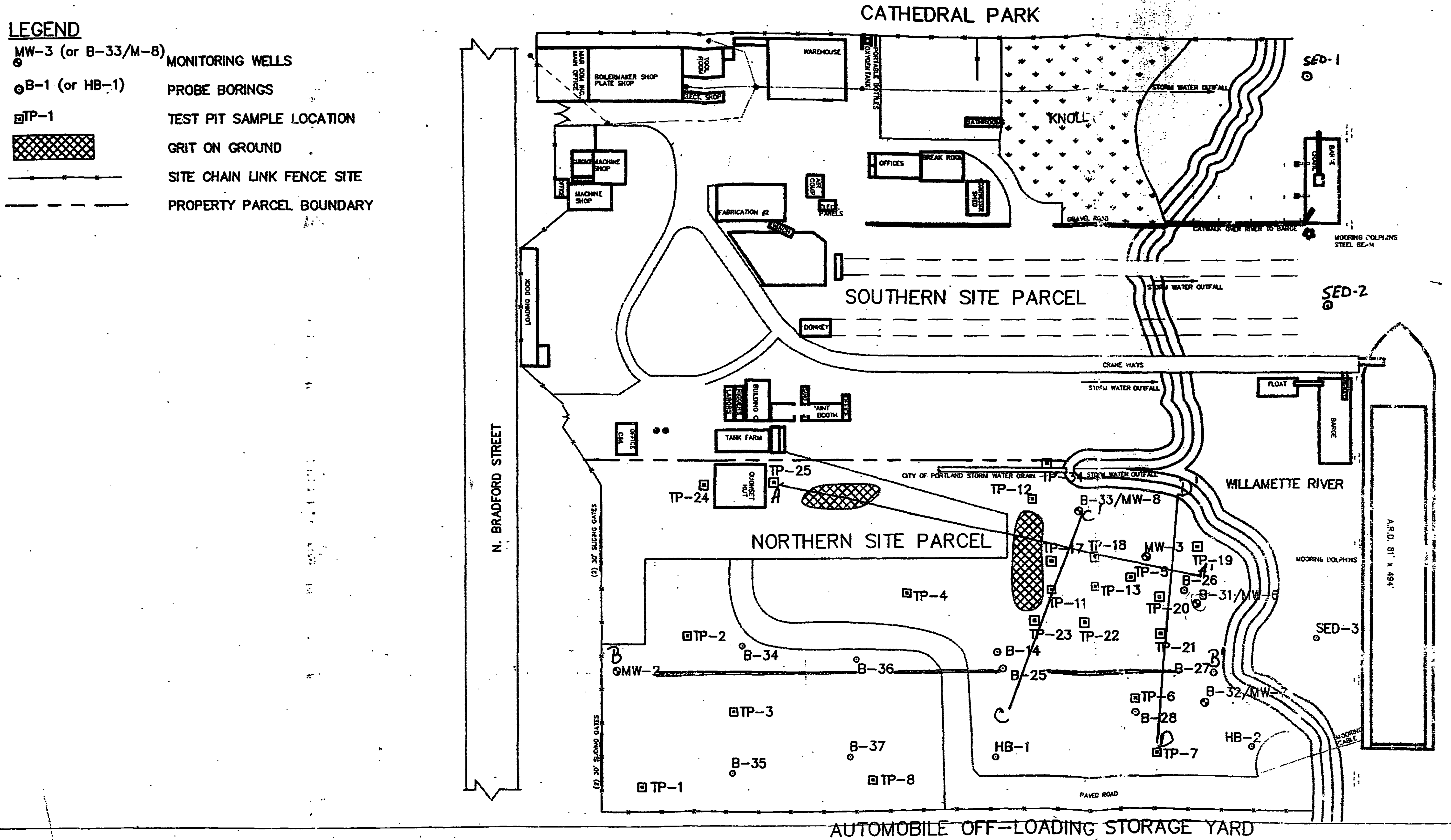
Figure 6
TPH Soil Data

MAR COM FACILITY
PORTLAND, OREGON



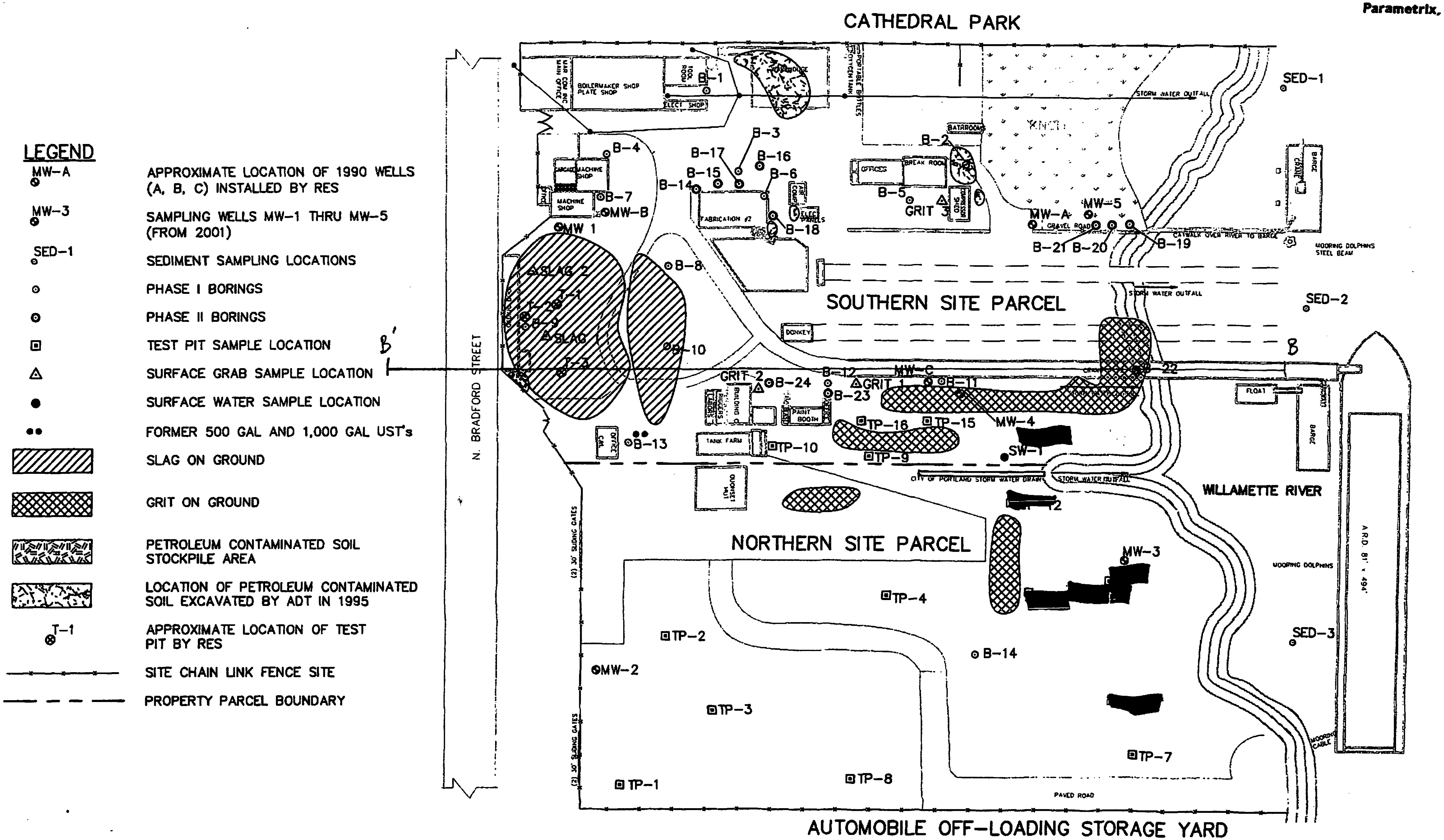
Parametrix DATE: 04/30/03 FILE: P4093002F-01

NOT TO SCALE

Figure 4 Sample Locations

Probe Boring, Test Pit and Monitoring Well Locations

NORTHERN PARCEL REMEDIAL INVESTIGATION, MAR COM FACILITY, PORTLAND, OREGON



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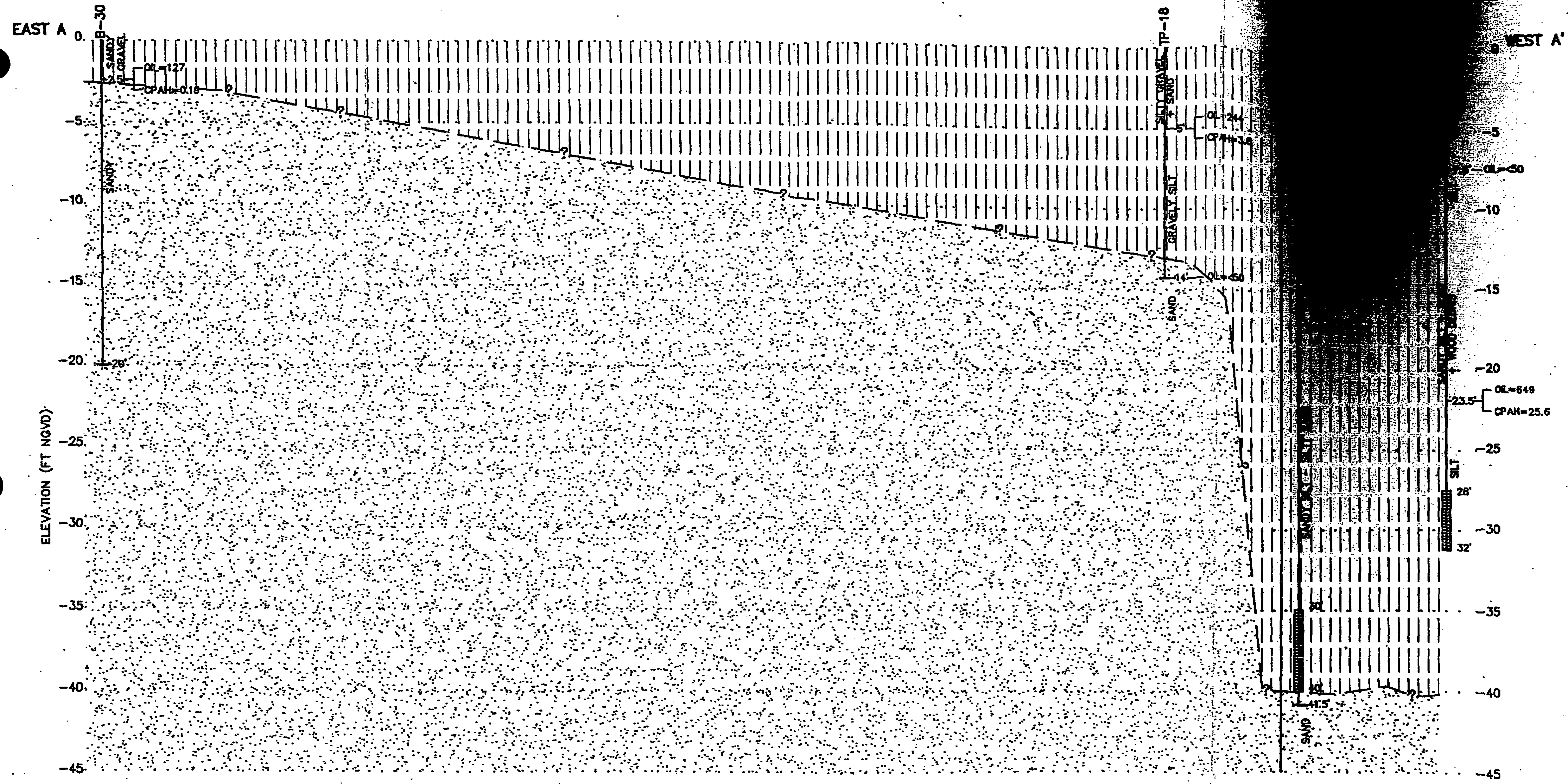
DATE: 08/29/02

Figure 4
Previous Site Investigation Locations
DRAFT WORK PLAN FOR REMEDIAL INVESTIGATION, MAR COM FACILITY, PORTLAND, OREGON



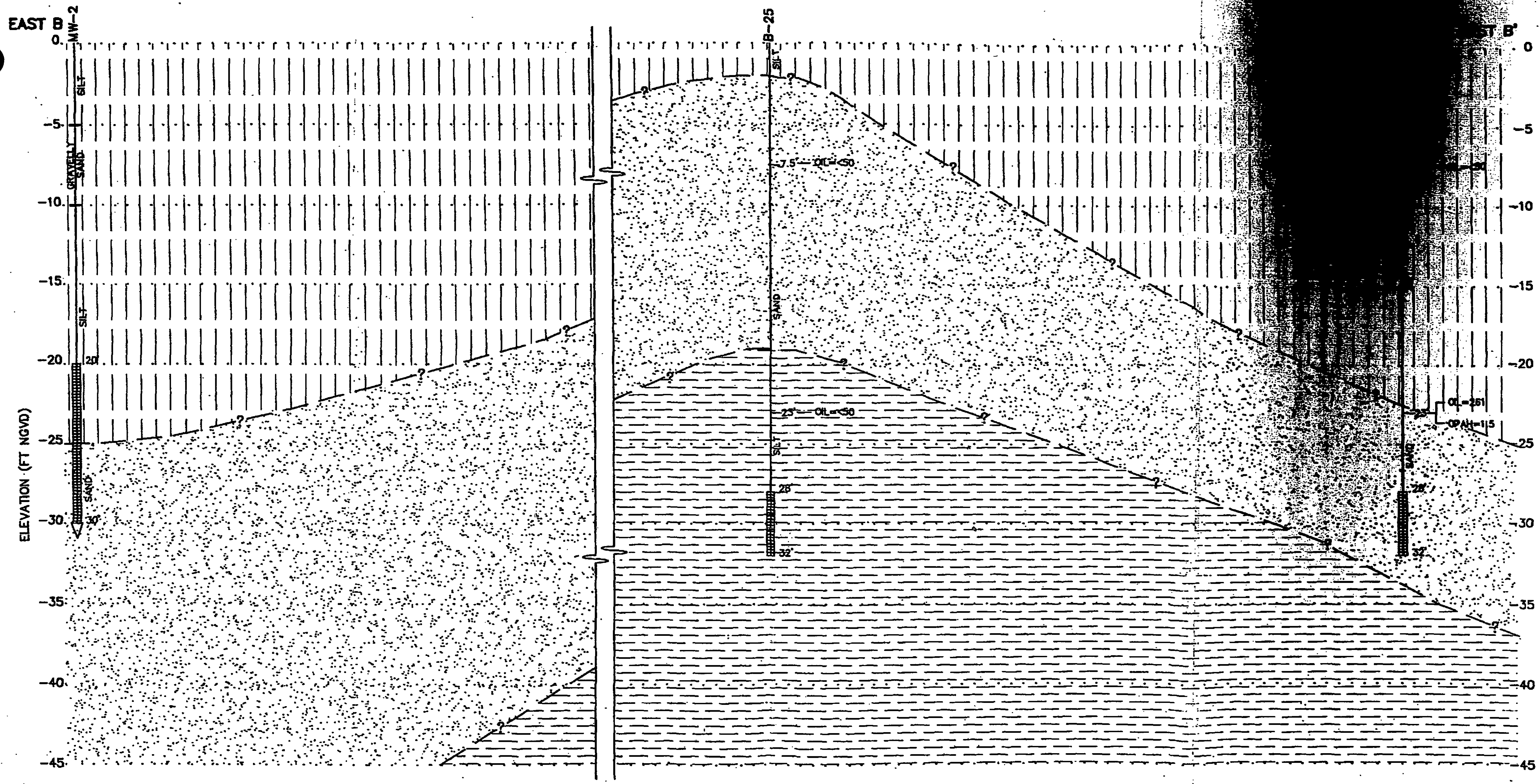
Parametrix DATE: 01/24/03 FILE: P4093002F04

SCALE: HORIZ: 1"=50'

LEGEND

- PROBE BOREHOLE OR MONITORING WELL
- MONITORING WELL OR PROBE BORING SCREEN LOCATION
- STATIC WATER LEVEL
- ? GEOLOGIC CONTACT
- FILL – SILT, CLAYEY SILT, SANDY SILT, GRAVELY SILT
- FILL – SAND
- ALLUVIUM – SILT, CLAYEY SILT
- OIL=<50 HEAVY OIL (mg/kg)
- CPAH=0.09 TOTAL CARCINOGENIC PAHs (mg/kg)
- 14' SAMPLE DEPTH (FEET)

Figure 5,
Cross Section A-A'
NORTHERN PARCEL RI
MAR COM FACILITY, PORTLAND, OREGON



Parametrix DATE: 01/24/03 FILE: P4093003F03

SCALE: HORIZ: 1"=50'

LEGEND

PROBE BOREHOLE OR MONITORING WELL

STATIC WATER LEVEL

MONITORING WELL OR PROBE BORING SCREEN LOCATION

— ? — ? — ? GEOLOGIC CONTACT

FILL – SILT, CLAYEY SILT, SANDY SILT, GRAVELY SILT

FILL – SAND

ALLUVIUM – SILT, CLAYEY SILT

14' OIL=<50 HEAVY OIL (mg/kg)

CPAH=0.09 TOTAL CARCINOGENIC PAHs (mg/kg)

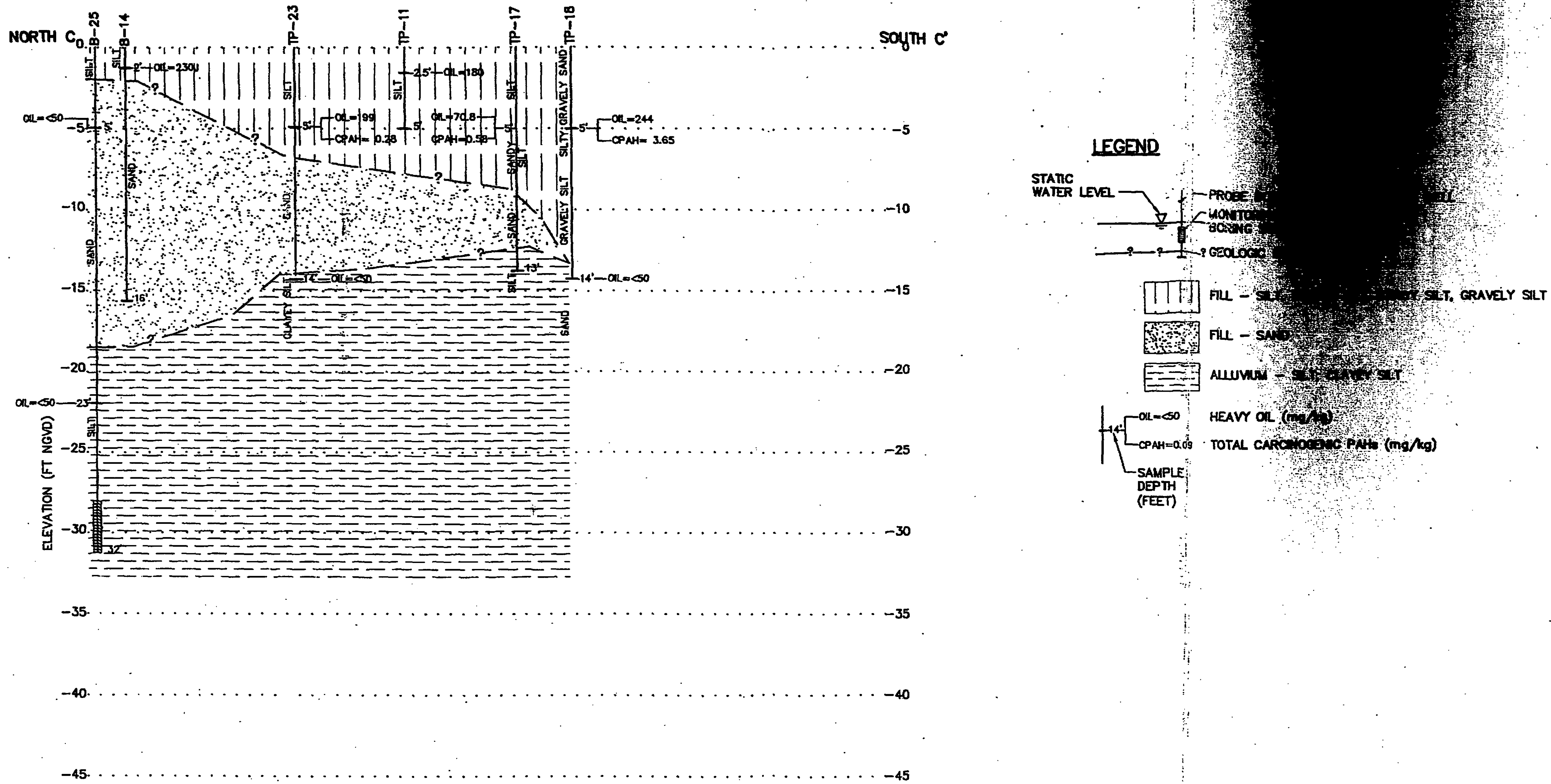
SAMPLE DEPTH (FEET)

Figure 6

Cross Section B-B'

NORTHERN PARCEL RI

MAR COM FACILITY, PORTLAND, OREGON

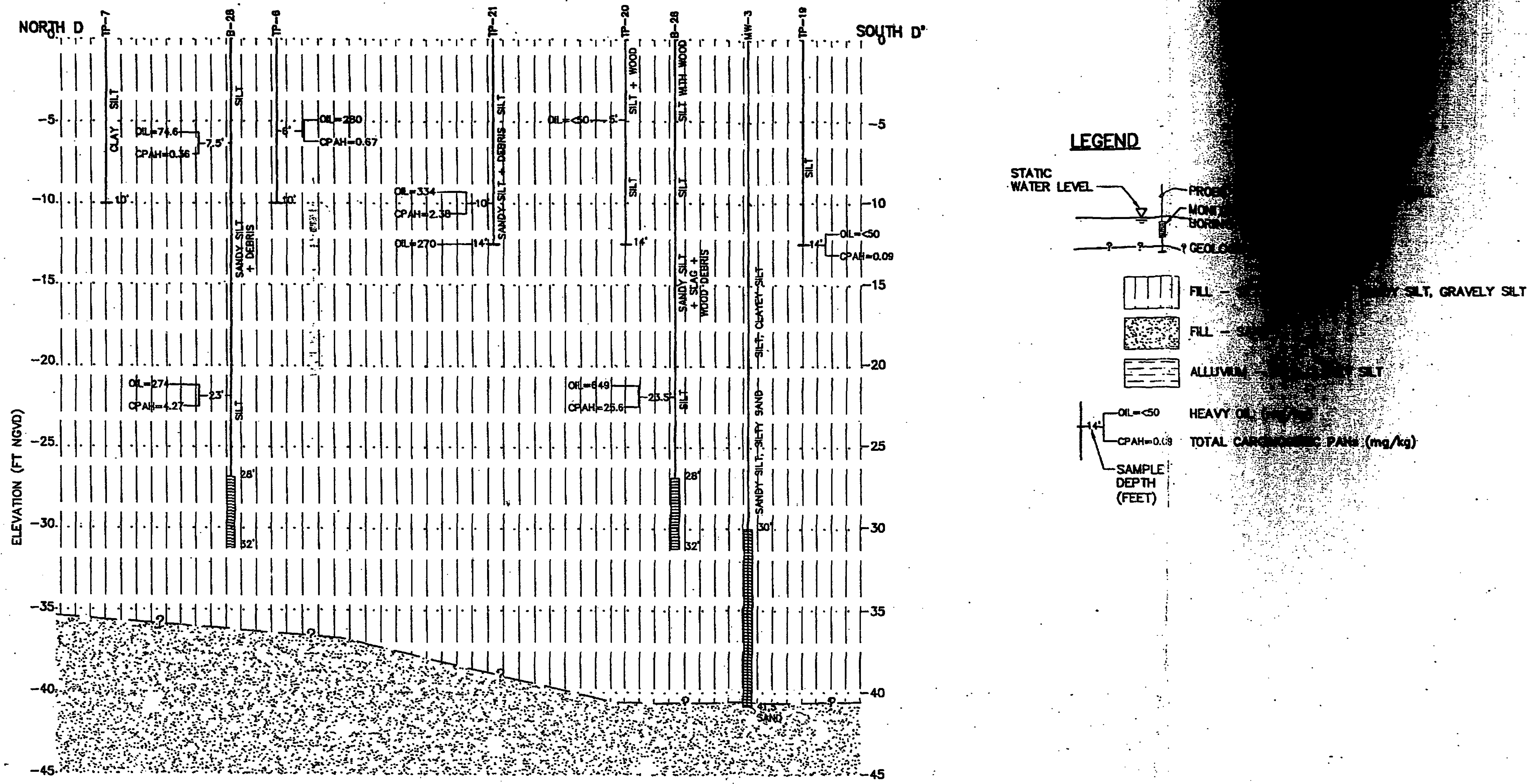


Parametrix DATE: 01/23/03 FILE: P4093002F03

SCALE: HORIZ: 1"=50'

Figure 7
Cross Section C-C'

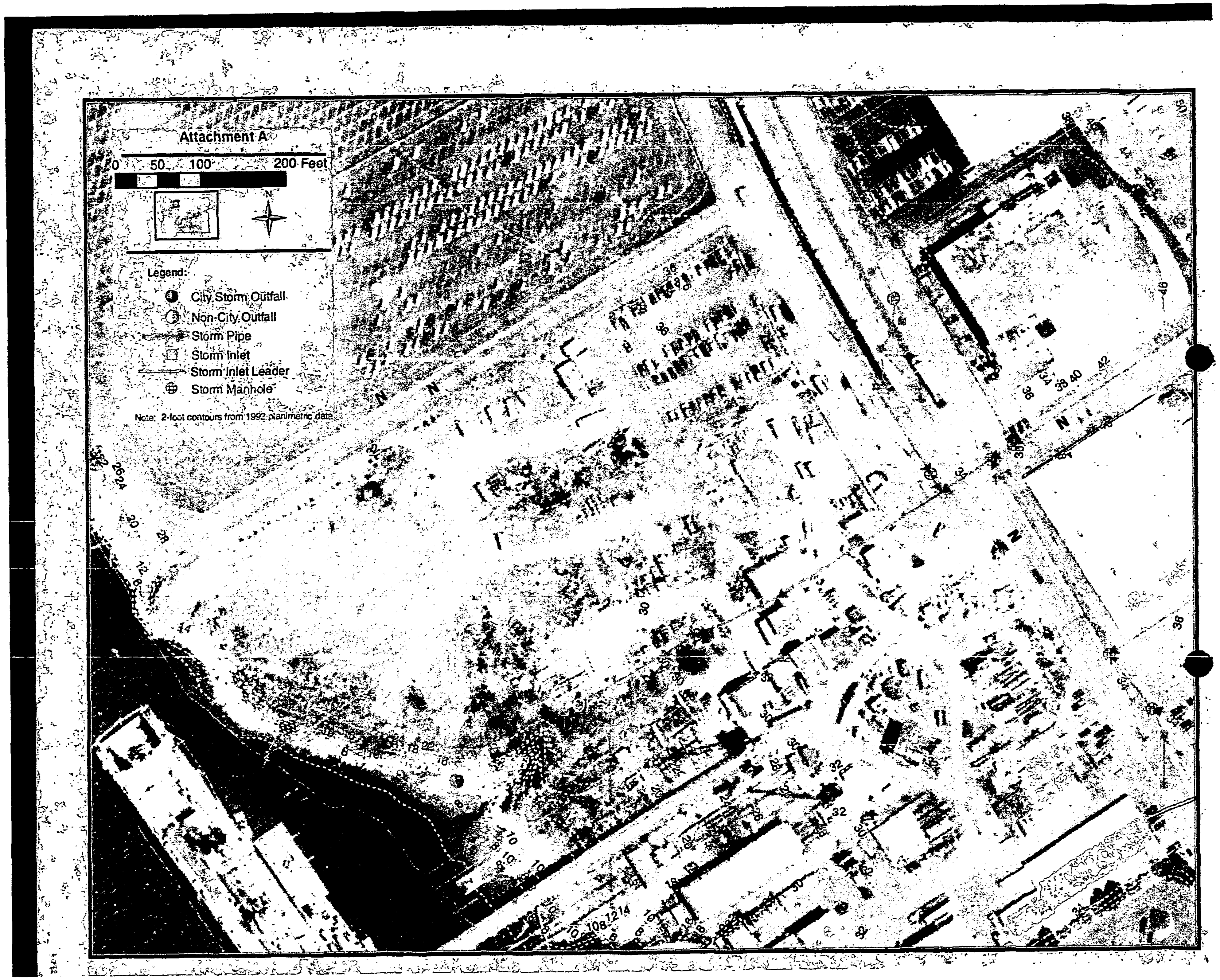
NORTHERN PARCEL RI
MAR COM FACILITY, PORTLAND, OREGON



Parametrix DATE: 01/24/03 FILE: P4093002F01

SCALE: HORIZ: 1"=50'

Figure 8
Cross Section D-D'
NORTHERN PARCEL RI
MAR COM FACILITY, PORTLAND, OREGON



Attachment A
0 50 100 200 Feet
N
Legend:
City Storm Outfall
Non-City Outfall
Storm Pipe
Storm Inlet
Storm Inlet Leader
Storm Manhole
Note: 2-foot contours from 1992 planimetric data

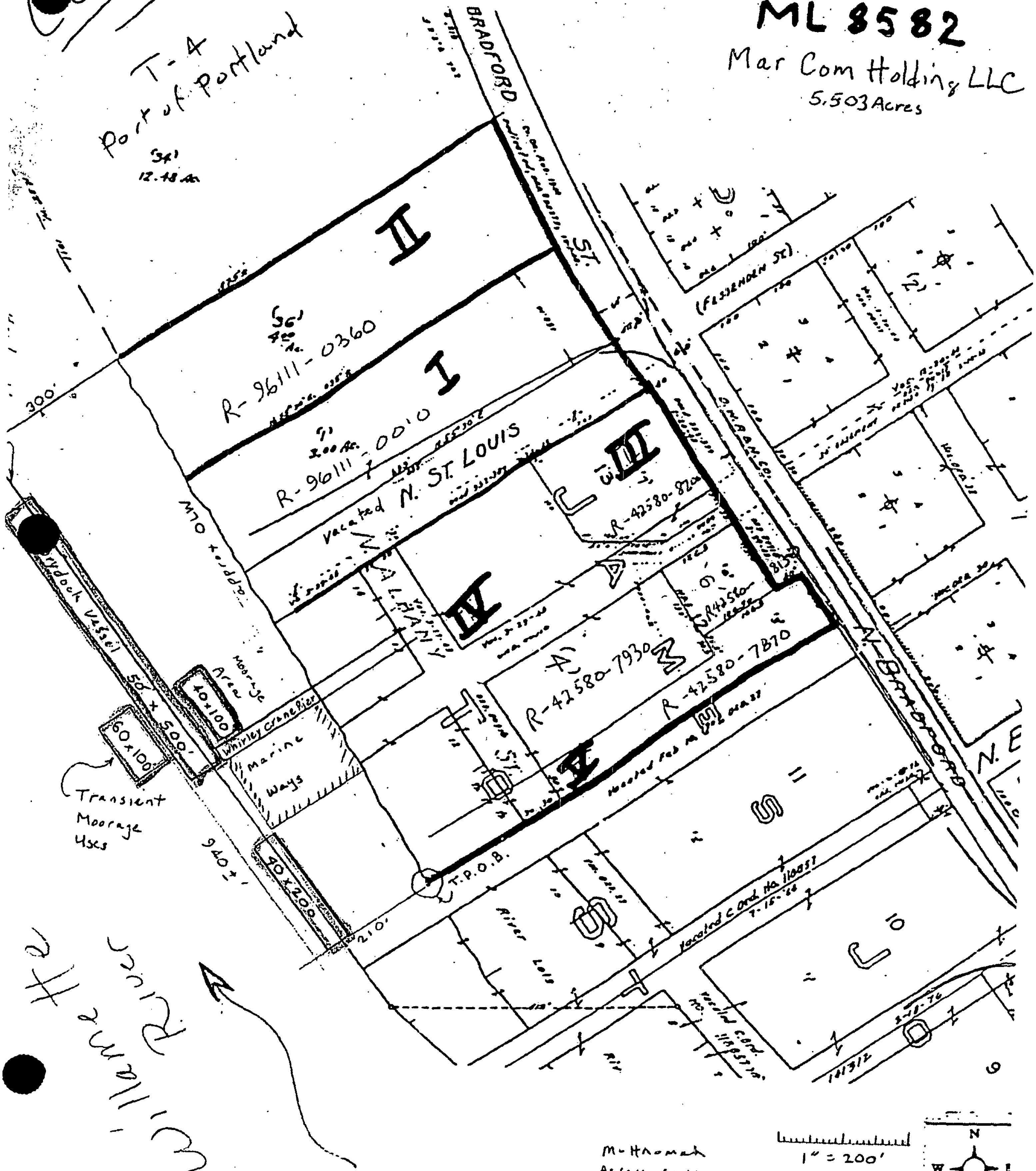
COPY

IN IW 11+2

Exhibit 'A'

ML 8582

Mar Com Holding LLC
5.503 Acres



Multnomah
Assessors Map
2120 Sec 11, IN IW

1" = 200'

J. Hedrick
Oct 30, 1998